MAGAZINE

OF

ZOOLOGY AND BOTANY.

ORIGINAL COMMUNICATIONS.

I. —*Some Remarks on the Study of Zoology, and on the present state of the Science.* By the Rev. Leonard Jenyns, M. A.; F. L. S.; F. Z. S.; &c.

Natural History has not only, like most other sciences, made great progress of late years, but it has assumed an importance, to which formerly it in vain attempted to lay claim. It is not, indeed, surprising that so long as it was restricted to collecting plants and animals as mere objects of curiosity, or judged to be of no further consequence than as it admitted of application to economic purposes, it should be either held up to contempt by the majority of thinking men, or tolerated only so far as it was studied with immediate reference to the ends just alluded to. But there are other grounds upon which, in these days, it is deemed worthy of our regard. The mere collector, indeed, is held in no higher esteem than formerly. The advantages we derive from an acquaintance with those organized beings which are capable of supplying the wants, or augmenting the conveniences of life, are not overlooked, but are considered rather as indirect benefits resulting from the cultivation of this science, than as the immediate objects to which all our researches incline. Natural History is of importance from the effects which it produces, or which at least it is capable of producing, upon the human mind. As a study, it tends equally with all other studies to strengthen the faculties, to fix the attention, and, to a certain extent, to exercise our powers of correct judgment and reasoning. As the particular study of those innumerable beings which people the earth, it has an especial tenden-

cy to infuse habits of accurate observation; and as one of its objects consists in tracing the complicated relations which these beings bear to one another, it naturally leads the observer to certain first principles of systematic arrangement, which being afterwards transferred to other subjects, are made susceptible of more general application. * There are yet further advantages which accrue from the pursuit of this science, sufficient to recommend it, even when followed for its own sake, and apart from all other inducements. The relaxation which it affords the mind, when fatigued with severer studies, or oppressed with anxiety;—the never-failing entertainment which it yields, even in the most retired and solitary spots;—the charms with which it can invest a country life, diffusing happiness over our leisure hours, and converting every walk into an intellectual treat;—these are fruits which will not be esteemed lightly, or considered by a reflecting mind as beneath its notice. Above all, we may allude to those devout meditations which this science is calculated to suggest to all such as are alive to the impressions of religion. It tends to uphold that secret communion with the Creator, which Revelation so much encourages. And if this remark has been often made, it only shows how general has been the feeling to which it relates. Strange, indeed, must be the perversion of that mind, which is made neither wiser nor better, by studying the works of Him, whose own wisdom is infinite, and all whose operations tend to good and happiness. We are not disposed to wonder because we find some to whom the study itself fails in affording the same degree of interest which we ourselves derive from it. But to have the thoughts leaning of their own accord to such pursuits;—to be able to expatiate with delight on that immense field of wonders which Nature opens to us;—to trace the workings of the most consummate skill, power, and benevolence;—and yet in our researches to find no room for moral improvement,—no incitement to remember the Great Author of all;—we fear this indicates a mind estranged from its own best interests, and but ill qualified for the more exalted employments of a future existence.

In what follows, it is proposed to confine our observations to that branch of Natural History termed Zoology. This, in its widest acceptation, may be defined as the science which treats of every thing relating to the structure, functions, history, and classification of animals. Under the head of structure, is included the form and arrangement of the several organs which enter into the composition of the animal body: under that of functions, the phenomena exhibited by

* See *Cuv. Reg. An.* Preface, p. xix.

these organs, when considered in action and in connection with the living principle. Hence it appears, that Comparative Anatomy and Physiology are properly subordinate departments of Zoology. Nevertheless, from the immensity of the field which is thus let in upon our view, these last may almost be regarded as distinct sciences; and the Zoologist be considered as restricting his enquiries more exclusively to the habits and classification of animals, and to those distinguishing characters by which their different relations are pointed out. Yet, since all natural arrangement is based upon a knowledge of the whole structure, he cannot safely advance on this head any further than the point to which that structure has been revealed by the anatomist. He may succeed in finding certain external signs by which it is possible to discriminate a particular group from all others, but these signs, in order to be of any value, must necessarily be co-ordinate with a given arrangement of the internal organs, which internal organs are therefore assumed as known.

It is difficult to form any adequate idea of the large number of facts, which it falls to the province of Zoology, even thus restricted, to record and classify. So various are the forms assumed by different animals;—so diversified their modes of life,—their habits and economy,—their instincts, whether exerted for the preservation of the individual or for the continuance of the species;—so dispersed the localities in which the yare found resident,—the earth,—the air,—the ocean,—all teeming with their respective inhabitants, and giving rise to a countless series of phenomena;—so complex too are the affinities by which they are severally related to one another;—that there seems hardly any limit to the enquiries which it becomes necessary to make in order to get acquainted with the details of their history. But our astonishment is excited most, by considering the immense number of species included in the animal kingdom, a number far exceeding that of plants and minerals put together. In an article in the Edinburgh New Philosophical Journal, published in October 1833,* the total number of known living species of animals, is estimated at 78,849. This, however, is probably far below the truth, since, according to Mr Macleay, upwards of 100,000 species of *Annulosa* alone are already contained in our cabinets.† What may be the entire number of species actually existing, in all the several classes combined, it is impossible to conjecture. Perhaps it may be thought that we are by this time nearly acquainted with the larger animals. But let it be remembered that a somewhat similar opinion was entertained by Ray so long

* Vol. xv. p. 221. † Hor. Ent. part ii. p. 468.

back as in 1690. The number of known and described species of *Beasts*, under which term *Serpents* also were included, was estimated by that naturalist as not above 150; and he added his belief that "not many of any considerable bigness, in the known regions of the world, had escaped the cognizance of the curious." The number of *Birds* known and described he considered as nearly 500; and the number of *Fishes* the same; and he supposed that "the whole sum of beasts and birds might exceed by a third part, and fishes by one-half, those known."* Now what has been the result of discovery since then with respect to these groups only? The number of *Mammalia* has been raised from 150 to 1200,† the number of *Birds* from 500 to 6500‡; the number of *Reptiles*, included by Ray amongst his *Beasts*, has reached to 1500 §; the number of *Fish*, which he considered the same as that of birds, to 8000.‖ But, however large may be the proportion of known to unknown species amongst the vertebrate animals, that proportion must be very different, and in all probability quite insignificant, in the case of the invertebrate. After all one thing is certain; that our lists have, from the earliest times, been gradually extending, in proportion to the increased attention which has been paid to the science; and judging from the immense accessions which they have received during the last fifty years, it is clear that if they continue long to augment in the same ratio, we must be yet at a great distance from the knowledge of the entire number. It may be safely asserted that the number of species left recorded by Linnæus in the twelfth edition of the Systema Naturæ, the date of which is yet upwards of seventy years posterior to that of Ray's work on the Creation, is certainly not one-twentieth part of those we are now acquainted with.

With this immense assemblage of beings, and with all their several peculiarities of character and economy, the Zoologist has to treat. Every part of their history calls for his investigation. He must search them out in their native haunts and recesses;—follow them through the several stages of their existence;—observe their habits;—trace the different degrees of resemblance between different species;—and, lastly, from the facts thus accumulated, endeavour to ascend to the knowledge of those general laws upon which depend their affinities and natural classification.—Well might Ray exclaim, with reference

* Wisdom of God manifested in the Works of the Creation. Sixth Edition, p. 21.

† L'Institut, 1834, p. 138.

‡ Edinb. New Phil. Journ. Vol. xv. p. 223. § Ibid.

‖ Agassiz, Rapport sur les Poissons Fossiles, &c. p. 57.

to such pursuits,—"Here is employment enough for the vastest parts, the most indefatigable industries, the happiest opportunities, the most prolix and undisturbed vacancies." And well might he add, in the words of Seneca,—"*Multum adhuc restat operis, multumque restabit, nec ulli nato post mille sæcula præcludetur occasio aliquid adhuc adjiciendi.*"*

If we turn from contemplating this extensive field to taking a general view of what has been as yet effected in it, we shall not be surprised at finding the progress of the science to have been very unequal in its different departments. This may be attributed to two causes. One is the natural predilection shown by most observers towards certain branches of Zoology in preference to others; those especially which are calculated to excite notice by reason of the size or beauty of the animals of which they treat. It is this circumstance which has obtained for the Mammalia and Birds so large a share of the attention of naturalists, whilst it has caused the Reptiles and Fish to be comparatively neglected. The same partiality appears in the case of the Invertebrate animals. It is notorious how the departments of Entomology and Conchology have had their respective admirers from the earliest times, and how seldom we have seen, till lately, any desire manifested to investigate the other portions of that immense group. If here and there we find certain individuals who have devoted themselves to the more obscure tribes;—if Ellis and Lamouroux and a few others have acquired celebrity by their researches into the nature of Corallines and other Zoophytes;—if the name of Müller will be for ever associated with the microscopic Infusoria, and that of Rudolphi with a class of animals from which most other observers would shrink with disgust;—these men stand as illustrious exceptions to the general indifference shown towards such departments, and shine the more conspicuous from having so few competitors in the same field. It may, however, be remarked that at the present day this source of unequal progress is much on the decline. Naturalists do not now restrict themselves so much as formerly to certain branches of the science. There appears to be an earnest wish to set them all as much as possible upon the same footing, and to bring up from the rear some which had for a long time been neglected and overlooked. But another cause operates yet more extensivel and more unavoidably to retard our knowledge of certain groups of animals, and that is the difficulty which in many instances attends the study of them. We find some whose ordinary place of residence is confined to stations not

* Wisdom of God in the Creation, &c. p. 173.

easily accessible, and whose habits and economy are in consequence almost entirely concealed from view. We find others possessed of such a delicate and fragile structure, that all attempt to convey them from their native spots, or to preserve them for future examination and comparison, is rendered hopeless. These remarks are especially applicable to the marine *Invertebrata*, with which our acquaintance is as yet comparatively slight. How many multitudes of species must there be immersed in the profound recesses of a deep ocean, where no net or line ever reached. How many more, which, if known, have been seen only at a casual glance, or at one period of their lives, leaving us in utter ignorance of the details of their history, and of the changes through which they pass in their advancement to maturity. How many, like the *Acalepha*, can hardly be removed from their native element, without entailing the entire disorganization of their substance; and if there be others which we succeed in preserving in our cabinets, how impossible it is, in most instances, to effect the preservation of those parts, on which depend perhaps their most important characters, and in ignorance of which we may adopt the most erroneous views respecting their structure and affinities.

We shall be able to appreciate more fully the impediments to the progress of Zoology arising from the sources last mentioned, if we bear in mind two points of great consequence to be remembered. One is the necessity of studying animals throughout their whole existence in order to become possessed of their true history. Not only do all animals differ more or less in their young and their adult states, but many, probably more than we are at present aware of, undergo such great changes of structure, that, unless viewed in their transition forms, it were almost impossible to identify them as the same species. There is no occasion to allude to the Batrachian Reptiles or to the true Insects, in which these changes have been noticed from the earliest times. But we may draw attention to the circumstance that metamorphosis, to a greater or less extent, has been recently detected in several groups in which it was not supposed formerly to exist, and that therefore we stand in need of further observation to say in what others it may not also occur. Without insisting on the universality of this phenomenon in the class *Crustacea*, which cannot be considered as established, and of which we shall have to speak further presently, we may allude to those marked changes of form which have been noticed in certain groups of that class by M. Milne-Edwards,* and which, if not amounting to actual metamorphosis proper-

* Ann. des Sci. Nat. 1835, tom. iii. p. 321.

ly so called, are sufficiently great to mislead the inexperienced naturalist. Equally important are those changes which have been traced with so much attention and care by Dugès in the case of the *Acari*,* and which have thus accounted for the apparent anomaly of hexapod and octopod forms coexisting in the same group. But there are other classes in which the metamorphosis is more complete, and attended by such an entire alteration of habits and economy, that by no possible *a priori* reasoning could we have been led to consider the young and adult states of such animals, if seen separately, as pertaining to the same species. Who would have suspected that the sluggish Barnacle, immoveably fixed to some rock or other marine substance, had ever enjoyed a free independent existence, swimming rapidly in the sea under the form of a small bivalve crustacean? Still less who would have anticipated the nature of those changes which attend the early development of the *compound Ascidiæ?* animals appearing at birth as separate individuals, and endued with the power of locomotion, uniting afterwards to form one common inert mass!—Yet these are the striking discoveries which have been made known of late years by different observers, and the accuracy of which there appears no reasonable ground for doubting. Now it will hardly be questioned whether it be important for the naturalist to be acquainted with these changes occurring in certain animals. It is obvious that, except he be, he will be constantly mistaking the immature states of such animals for distinct species, or perhaps be even referring them to distinct genera. We know that such errors in fact have occurred over and over again. Thus the larvæ of the *Acari* were, until the researches of Dugès, regarded as permanent forms, and made to constitute a peculiar family in that group comprising several genera. The same was the case formerly with some of the *Entomostraca*. It is also probable that many of the minute animals, which now stand in our systems as distinct forms, are only the first states of some of the higher ones, in which the existence of metamorphosis remains to be discovered.† But it is not merely to avoid the overmultiplication of genera and species that this acquaintance with animals at different periods of their growth is wanted. It is necessary in order to obtain correct views respecting their affinities. There was a time when, to attain this object, it was thought sufficient to look only to the perfect state of the species, and scarcely any notice was taken of the

* Ann. des Sci. Nat. 1834, tom. i. pp. 5 and 144; and tom. ii. p. 18.

† Milne-Edwards thinks it probable that some of the *Cercariæ* are only the young of the *compound Ascidiæ* during the first stage of their existence.—See Lamarck's Hist. Nat. des An. sans Vert. (2d edit.) tom. i. p 428.

previous stages through which it had passed. This idea, however, is in a great measure abandoned. It is now ascertained that the changes of structure experienced by different animals are all the result of certain fixed laws, closely connected with those which regulate their affinities. Genera which are dissimilar in their adult states sometimes resemble one another during the first periods of their development, thus indicating a relationship which would escape our notice except we were made acquainted with their early history.* It was not until their metamorphosis had been detected, that the *Cirripeda* were fully ascertained to be allied to the *Entomostraca*, or the *Lernææ* to the *siphonostomous Crustacea*.

Another point of no less importance to be attended to than the study of animals at different periods of their existence, is the study of their whole structure. We need only observe how imperfect our arrangement of the *Mollusca* was, so long as conchologists contented themselves with the knowledge of shells, apart from all regard to the nature of their animal inhabitants; or how far we are still removed from understanding the affinities of several other groups, of whose structure we know little beyond the external form.—In all such cases we are carried away by partial resemblances, and led to attach an undue value to organs exercising only a subordinate function in the economy. Thus the characters afforded by shells are not necessarily in direct connection with those derived from the internal organization. Several instances to the contrary have been adduced by Mr Gray in a paper lately published in the Philosophical Transactions.† The most remarkable are those of the genera *Patella* and *Lottia*. It is observed that in these genera the shells are so perfectly alike, that after a long-continued study of numerous species of each genus, Mr Gray cannot find any character by which they can be distinguished with certainty, yet their animals are so extremely dissimilar, as to be referable to two very different orders of *Mollusca*. The Zoophytes or *Polypi* have been subjected to the same misarrangement as the *Mollusca*, owing to attention having been given almost exclusively to the nature of the calcareous covering. It was thought by Lamouroux, that this alone was sufficient to serve as the basis of their classification. It is now found that the included animals exhibit very

* It would lead us too much into detail, or we might here allude to those beautiful generalizations lately established by Milne-Edwards with regard to the changes of form which occur before and after birth in the *Crustacea*.—See his memoir in the Ann. des Sci. Nat. already alluded to; also a Report on that memoir by M. Isidore Geoffroy St Hilaire. Id. 1833, tom. xxx. p. 360.

† Phil. Trans. 1835, p. 301.

different degrees of complexity of structure; and that while some are true *Polypi*, others are more nearly allied to the *compound Ascidiæ*.* Indeed it may be observed generally, that the lower we descend the scale of organization, the less reliance are we able to place upon mere external characters, and the more it becomes necessary to investigate those derived from anatomical researches.

Did our limits allow, we should here proceed to notice the most recent additions which have been made to our knowledge of animal organization. We might pursue the subject through each department of the science, and show the endeavours which were being made to advance its progress, as connected with the two principles above alluded to. But we can scarcely do more than make a few general remarks on this head, referring for illustration to the more important instances. And first, we are called upon to notice the increased attention paid at the present day to the structure of the more minute and delicately-formed animals; and the discovery, uniformly following, that this structure is not by any means so simple as was generally supposed formerly. This remark bears especially upon the *Infusoria* which have been so profoundly studied by Professor Ehrenberg. We need not speak of the first two memoirs by that acute observer on these animals, which are probably well known to all our naturalists. We may, however, allude to a third, published more recently,† in which he announces the existence of several systems of organs which he had not previously detected in this group.—Thus he has discovered in the *Polygastrica* a pharynx and teeth, the absence of which he had formerly considered as a distinctive character of that division. He has also observed what he is inclined to regard as male sexual organs, and likewise a gland secreting a deep blue-coloured liquid supposed to be the pancreatic fluid. In the *Rotatoria* he has noticed certain internal organs resembling branchiæ, and, what is a yet more important step, apparently distinct traces of a nervous system. It is curious to reflect, as Ehrenberg himself observes, with reference to the combined discoveries announced in this and in his two former memoirs, that he has been thus led successively to detect in the smallest animals which can be perceived with the assistance of the microscope, all the systems of organs which form the essential part of the human structure; and that these organs are not rudimentary, but, after their kind, as perfect as they are in man. It would seem as if

* Ann. des Sci. Nat. tom. xv. p. 5.

† An abstract of this memoir will be found translated into French, in the Ann. des Sci. Nat. (Second Series.) tom. iii. pp. 281 and 363; and into English, in the Edin. New Phil. Journ. vol. xx. p. 42.

but one type pervaded the whole animal kingdom, which, however modified in different groups, was capable of being traced from man downwards to the *Rotatoria*, and even to the *polygastric monad*. Hardly less striking than in the case of the *Infusoria*, is the astonishing accuracy with which the German naturalists have investigated the structure of the more minute *Entozoa*. We may refer to M. Nordmann's work * as evincing the patience with which these researches have been conducted in the instance of certain parasitic worms found in the eyes of some of the higher animals. The whole group is one which stands much in need of further examination; and we are glad to find that it has recently engaged the attention of one of our own countrymen, Mr Owen, who has suggested several hints for a better arrangement of its heterogeneous contents.† Although not in all cases offering any difficulty to the anatomist in respect of their size, we have already alluded to the *Acalepha* as possessing an extremely delicate and transparent organization. M. Ehrenberg has availed himself of this very circumstance for employing the same method of examination in this class, already so successfully resorted to in that of the *Infusoria*.‡ By means of indigo, used for colouring the water in which these animals were preserved, he has detected the existence of anal openings, which, previously to this experiment, were thought wanting. The same observer has satisfied himself, that, notwithstanding their supposed simple structure, they possess branchiæ, eyes, muscles, and nerves. It will be remembered that these last had been previously discovered in the *Acalepha* by Dr Grant.§ The species principally examined by Ehrenberg was the *Medusa aurita*. In the same paper containing the result of his researches, are detailed some observations on the structure of the *Echinodermata*.— Allusion has been also made to the *Polypi*, as a group which, until lately, had been much misunderstood, owing to our slight acquaintance with their internal organization. Milne-Edwards, to whom we are mainly indebted for removing part of the obscurity which hung over these animals, has made them the subject of two new memoirs read to the Royal Academy of Sciences at Paris during the past year. We must refer to the memoirs themselves for some interesting par-

* Mikrographische Beitrage zur Naturgeschichte der wirbellosen Thiere. Berlin, 1832. 4to. Some extracts from this work will be found in the Ann. des Sci. Nat. for 1833, tom. xxx. pp. 268 and 373.

† See Proceed. of Zool. Soc. 1835, pp. 23–28; and pp. 73–76.

‡ See Ann. des Sci. Nat. 1835, tom. iv. p. 290.

§ Zool. Trans. vol. i. p. 10.

ticulars connected with the structure and economy of these animals.* We can only state here, that, according to the researches of that gentleman, the former offers three very distinct modifications, of which two only belong properly to the type characteristic of the *Radiata*. In these two he has traced an organization gradually becoming more and more simple from the *Actiniæ* and *Beroes* down to the *Hydræ*. The third series opens a passage from the *compound Ascidiæ* to several of the *Infusoria Polygastrica* of Ehrenberg.

When speaking of the importance of studying animals at different periods of their growth, we pointed out certain groups in which striking changes of form had been observed to take place, approaching more or less to the nature of metamorphosis. The desire to investigate further these structural changes forms another prominent feature in the memoirs of the present day. The *Cirripeda* and *Crustacea* have excited particular interest on this head. It is well known that Mr Thompson was the first to announce the existence of metamorphosis in each of these two classes, a fact which has been since confirmed by others as regards the *Cirripeda*, but which is much doubted by naturalists as regards the *Crustacea*. During the past year, two memoirs have appeared from the pen of this gentleman devoted respectively to these two subjects. The object of the first† is to make known the discovery that the *Lepades* are, like the *Balani* (to which last his former researches alone extended), *natatory Crustacea* during the first stage of their existence, but of a totally different structure. The larva is said to resemble that of the genus *Cyclops*, or still more closely that of the *Argulus armiger* of Latreille. Mr Thompson is uncertain how long the *Lepades* remain in this their first or free state, but thinks that it is for a longer or shorter period, according as they may happen to meet with a substance adapted to their habits, to which they can attach themselves. In his second memoir, Mr Thompson treats of the *Crustacea*; and his object is, not merely to confirm his former statements respecting the existence of metamorphosis in this class, but to announce the startling discovery that these animals, before attaining to their perfect form, undergo *two* marked transformations, analogous to those experienced by the true insects.‡ It will be remembered that the first state in which

* See L'Institut, 1835, pp. 10 and 152. Also Ann. des Sci. Nat. (Second series.) tom. iv. p. 321.

† Discovery of the Metamorphosis in the second type of the *Cirripedes*, viz. the *Lepades*, completing the natural history of these singular animals, and confirming their affinity with the *Crustacea*.—Phil. Trans. 1835, p. 355.

‡ On the double *Metamorphosis* in the Decapodous Crustacea, exemplified in *Cancer Mœnas*, Linn.—Phil. Trans. 1835, p. 359.

the *Crustacea* appear, according to the views of this naturalist published some years back, is identical with the genus *Zoea* of Bosc: the second is here affirmed to be the genus *Megalopa* of Dr Leach. The species in which this double metamorphosis has been more particularly noticed is the *Carcinus Mœnas*.* We have said that doubts exist respecting the accuracy of these observations. It is rather singular that in the same volume in which Mr Thompson's paper is contained, there should be also one by Mr Westwood, who is opposed to the views of that gentleman, and who, in our opinion, has very much shaken the grounds for believing in the existence of any metamorphosis at all. Mr Westwood has not only shown that Mr Thompson's statements are too vague and indefinite, and his observations too deficient in details, to be accepted as conclusive of this question, but he has brought forward some observations of his own of a directly contrary nature. From specimens of the female of the West Indian land crab, he has obtained both eggs and young, some of the latter being evidently just hatched; and he finds these young, as well as the embryo in the egg, bearing the exact form of the adult animal. It may further be added that Mr Westwood has found the young of the common crab of a much smaller size than Mr Thompson's supposed full-grown *Zoea* which died on the point of undergoing its supposed metamorphosis.†

In reviewing the memoirs which have appeared of late years in illustration of the structure of animals, there is yet another circumstance which merits our attention; and that is—the endeavour to elucidate the affinities even of those belonging to the higher classes, by having recourse to anatomical investigation. The importance of this step in the case of the *Mollusca*, and of other tribes occupying a low place in the scale of organization, has been already alluded to, and for some time been duly appreciated by naturalists. But, comparatively speaking, it is only more recently that such researches have been extended to the *vertebrate* and *annulose* animals, with an express view to the object above-mentioned. To enter into any detailed analysis, or even to particularize the titles of the different memoirs which have appeared of this character, would lead us beyond the limits to which we must necessarily restrict this article. But we wish

* On the supposed existence of *Metamorphosis* in the Crustacea.—Phil. Trans. 1835, p. 311.

† Zool. Research. p. 9.—It may not be out of place to mention here for the information of our own naturalists, that the supposed *Metamorphosis of the Crustacea* has been recently proposed as the subject of a prize-essay by the Academy of Sciences at Haarlem.—See L'Institut, 1835, p. 272.

to make a few general remarks on this subject, in reply to those who apprehend any detriment to the science of Zoology from the dissections of the comparative anatomists. We are not, then, of the same opinion with these individuals. We rather think that the further we push our inquiries into the real structure of animals, the clearer views we shall get of their organization as a whole, and of the relations which subsist between their internal and external characters. We allow that these last are what the Zoologist has to deal with more particularly. But let it be remembered, that before he can employ them rightly, he must know their true value; and this can hardly be determined, except he possess an acquaintance with those concealed organs, and their respective functions, of which they may be considered as the outward signs or indices. Let us assume the case of two allied species, in which we observe slight differences in certain external characters! and let us suppose that on dissection we find corresponding differences in those internal organs, between which and the former there is an acknowledged relation; as in the instance of the teeth and the alimentary canal. Let us, again, assume another case, in which we find these differences existing in the former only, there being nothing analogous to them in the latter. Now, under such circumstances, should we not infer rightly, that this slight modification of external structure had a more determinate value in the first, than in the second, instance; and is it not clearly a result, to which nothing but anatomy will conduct us? It is, in fact, this subordinate science which has led us to a right understanding of some of the primary groups among the higher animals, and it is only by the same help that we can ever hope to perfect the details of their arrangement. There was a time when bats were considered as birds, and whales as fish; and lizards were classed with quadrupeds simply because they possessed four feet. These errors, it is true, have been long exploded; but we wish it to be borne in mind, that it was not until naturalists had ascertained the real organization of these animals, that the absurdity of them became apparent. It was then seen that external form, or mere analogy of habits, considered singly, was no sure guide to the knowledge of true affinities. Now the question is—whether this principle which is thus necessary to be remembered on our first attempting to group animals according to their natural relations is ever to be abandoned afterwards? After having made good in this manner our first steps, can we safely trust to any different reasoning for insuring our progress? It is clear that the errors we may commit by so doing will be less glaring than those above-mentioned, in proportion as we have to deal with slighter differences than those which separate two distinct clas-

ses of animals. When the question is reduced to—whether two animals belong to the same species, or whether two species can rightly be referred to the same genus, we can but commit an error of one or a few steps, which, when detected, will excite but little notice. Nevertheless, we believe that we should much lessen all chance of error, by knowing the whole structure of the animals before us. In the present state of the science, it is necessary to have recourse to very subtle external distinctions for characterising genera and species. But their very subtility is an argument for enquiring as far as possible into their true value; and it remains yet to be shewn, that there are not, at least in many cases, as subtle distinctions to be found internally, with which the former are associated, and which, being known, tend to raise their importance. It is, then, on these grounds that we rejoice to see so much endeavour at the present day to elucidate the internal organization of animals. Much has been done in this respect by the Zoological Society, which affords to naturalists the double advantage of studying the habits of those animals which it possesses while living, and of investigating their anatomical structure when dead. We need only refer to the Proceedings and Transactions of that scientific body, to see the advance which has been made of late years in this very important department of Zoology.

But there are other grounds upon which we may take up this argument. Comparative Anatomy is of service to the Zoologist, not merely for helping him to the true value of external characters, but in some cases for determining the actual nature of those external organs from which these characters are derived. As an instance in point we may refer to a remark lately made by Professor Agassiz respecting the supposed affinity of the *Cyprinidæ* to the *Siluridæ*. It would seem, says he, that "from the bearded *Carps* to the bearded *Siluri* there was a natural transition by means of the bearded *Loaches;* but it is important to distinguish that in these latter, as well as in the *Carps* and other *Cyprinidæ*, the beards, as they are called, are merely processes of the skin; while in the *Siluri*, the *cirri* of the angles of the mouth are actually prolongations of the maxillary bones becoming gradually cartilaginous and tapering into thread-like extremities." * This appears, then, to be a case, in which naturalists had supposed two external organs to be of a similar nature, which, upon dissection, prove different. We do not assert that the affinity between these tribes has been grounded solely upon the presence of such organs: we simply inquire, whether our views are not necessarily a

* Proceed. of Zool. Soc. 1835, p. 150.

little modified on ascertaining the true organization of those parts from which we have hitherto drawn some of our characters; and whether, on combining the result thus obtained with the results of a more extended anatomical investigation, it is not at least possible, that the relation of supposed affinity may prove eventually to be one of mere analogy.

The only instance in which anatomical researches have been misapplied, as regards Zoology, is that in which they have led to the formation of systems based upon certain parts of the internal structure of animals, without regard being paid to the relation in which these parts stand to the rest of the organization, and the consequent degree of influence which they exert over the economy. This has been sometimes attempted by persons, who have generally been good anatomists, but ignorant of the first principles of Zoology. Yet even these systems are not entirely without their use to the naturalist.—Although worthless as a whole, they may suggest certain affinities which might otherwise have been passed over. They at least teach us the method of variation of those organs upon which they are established; acquaint us with their true value; and throw more or less light upon the real relations which subsist between those characters which anatomy furnishes, and those with which Zoology is more immediately concerned.

But it is time that we pass from these remarks to inquiring into the present state of the science, as regards that, in which the scientific Zoologist is so much interested,—a natural classification of animals.

And here we must state, that it is not our intention, neither would it be practicable within the limits of this article, to analyze in detail any of the numerous systems which have been brought forwards of late years. We simply purpose making a few observations on the views which naturalists seem to entertain on this subject. The most important feature in the present times is—the endeavour, now made almost universally, to refer the affinities of animals to some fixed principles of arrangement,—some general plan determined by certain laws. We can hardly doubt of there being such a plan, upon which the Great Author of Nature has formed the innumerable creatures which people the earth. When we see the harmony which pervades the rest of his works;—when we become acquainted with the beautiful laws which have been discovered in other sciences;—when, especially, we call to mind the principles established in those which border most closely upon Zoology;—we can hardly but conceive, that this science also admits of some generalizations, and that animals are as much under the influence of given laws in respect to their affinities, as they are in respect to their structure. Now it may be true that the first idea of

the existence of such a plan belongs to a much earlier period than the present; and that Linnæus, and even the older naturalists, had some faint notions upon this subject; but, until the close of the last century, there was hardly any attempt made to elucidate its principles; and only quite recently has this attempt, with some few exceptions, become general. The reason is obvious. The science had not made sufficient progress to warrant the endeavour. And for the same reason, it is obvious we must await the arrival of many years to come before we can hope to see that endeavour perfected. We are not, then, surprised to find, that although naturalists are everywhere pursuing the same object, they are following very different roads in the hope of attaining it. We should wonder if it were otherwise. When we think of the immense field which Zoology lays before us,—of the comparatively small portion of that field as yet explored,—and of the impediments which arise to make our path difficult;—when we reflect further, how much is required to determine the exact relations of a single group,—and how often we are left to mere conjecture and analogy, in the absence of facts, which can alone establish our reasonings on a sure basis;—we are prepared to meet with much variety of opinion upon such a subject. It is, indeed, more than probable that the classification of animals is destined yet to undergo, at least in part, great and important changes.* The views of naturalists will differ, according as they have paid most attention to this or that department of the science, in each of which, from the unequal progress of our knowledge, we appear to recognize the influence of distinct principles. Their minds, too, will receive, unconsciously to themselves, a slight bias, arising from the nature of their other studies, or of those which led them to the particular study of which we are here speaking. It is only time which can do away with the erroneous conclusions of a partial or a prejudiced judgment. Contrariety of opinion originating in the above sources, is for a season unavoidable; and we must wait patiently till we have received sufficient light to determine those questions, with respect to which naturalists are so much at issue.

But independently of what has been above-mentioned, there is another and distinct ground of difference observable in the attempts which have been made of late years to arrange animals upon some uniform plan. In fact, as has been recently said,† there are two distinct prin-

* We may mention in this place, that a new arrangement of the Animal Kingdom has been recently brought forward by Professor Ehrenberg of Berlin. It is divided into 29 classes founded on the organization, and on the general existence of one type of structure, as respects the system of sensation, circulation, locomotion, nutrition, and reproduction.—See L'Institut, 1835, p. 305.

† Lam. Hist. Nat. des An. sans Vert. (2d edit. 1835.) tom. i. p. 336.

ciples upon which we may proceed, each being in accordance with certain obvious relations existing in nature. We may either take for our guide the principle of the subordination of characters, successively grounding our divisions upon modifications of structure becoming less and less important as we proceed downwards; or we may seek to distribute animals into as many principal groups as there are well-marked series, each of these series being characterized by a peculiar type of organization gradually becoming more and more simple in its descent. The former of these principles is that which was first developed, and so strenuously upheld, by the great Cuvier, and which is still adhered to by a large proportion of the naturalists in France and in our own country. The latter may be distinguished in many of the systems which have appeared in Germany, as well as in some which have emanated from other quarters. It may be said, that, as there can be but one natural system strictly speaking, it is impossible that both these principles can conduct to true results. This would be correct if animals exhibited only one *kind* of relation to each other. But we know that they exhibit more than one; and hence we are not without hope, that, notwithstanding the opposite nature of these principles, the day may come, in which it will be found possible to reconcile the views to which they have respectively given birth. We, in fact, are inclined to think, that some slight approach to this reconciliation already shows itself in the theories of those naturalists who distinguish between *relations of affinity* properly so called, and *relations of analogy*. It does not follow, that the theories themselves, by which it is attempted to explain these relations, and to refer them to given laws, are necessarily correct. Which, or whether any, of them can be so regarded, is a matter for time to determine. We would here simply draw attention to a point which may hereafter prove in some measure a bond of union between two conflicting opinions of the present day, and conduct at length to truths of which it will be then found that each party had some faint glimmerings.

There is another circumstance which tends to confirm our hopes that naturalists are approaching gradually to some just and uniform results, and which merits notice. And that is, that, notwithstanding the diversity of their views respecting the details of systematic arrangement, —there may often be observed certain features of resemblance (not of identity) in the general principles from which they set out. This resemblance may be especially traced in two very different schools established in Germany and in our own country respectively. Thus, for instance, the principle first laid down by Oken, that the classes of the animal kingdom are severally characterized by the particular develop-

ment of some one of the animal functions, and that these characters are continually reproduced in the subordinate divisions, causing each group to contain representations of those above it together with its own peculiar type ;—this idea offers some analogy to the " Theory of Representation" of Mr Swainson,* which is itself only an extension of one of the views adopted by Mr Macleay.†—We may also refer to the idea, that the subordinate divisions of every natural group are controlled by some fixed number,—as another point of resemblance in the two schools. This principle, indeed, seems to follow from the one just mentioned as a necessary consequence, since if two groups do not contain exactly the same number of divisions, it is impossible that the larger number can be all duly represented by the smaller.

We must observe in this place, that, in making the above remarks, we do not wish to be considered as upholding the particular views of either school just alluded to ; much less the details of those systems, which they respectively advocate. We are simply adverting to a certain similarity of principle which pervades them both. That animals do appear, in a multitude of instances, to represent, as it were symbolically, others, with which they are connected by no immediate affinity, must have struck the most inattentive observer. It is also in the highest degree probable, that these relations, as well as all others, are in accordance with some fixed laws. But whether these laws will be found in the end exactly as they are laid down by either of the parties above referred to,—whether by making some slight modification in either of their peculiar theories, or by combining their principles in any manner,—we may be able to attain ultimately to some result, not very different from the results at which they have respectively arrived;—these are questions, which, as we said before, time only can determine. We are aware that this assertion will appear somewhat strange to Mr Swainson, who has recently developed more at large his modifications of Mr Macleay's theory,‡ and who considers his own first laws as established upon incontrovertible evidence. But with all deference to the talents of that distinguished naturalist, and with every wish to receive the truth, when it shall be proved to the satisfaction of unprejudiced minds, we cannot entirely accede to this opinion. Mr Swainson does not seem to be aware of the existence of a school of naturalists in Germany,§ who profess equally with himself to refer the classification of

* Faun. Bor. Am. part 2, p. xlviii. ; and Classific. of An. p. 236.

† Hor. Entom. part 2, p. 518.

‡ See his Preliminary Discourse on the Study of Natural History. Lond. 1834. Also his Treatise on the Classification of Animals, 1835.

§ We infer this from the circumstance that no notice whatever is taken of this

animals to some *general* principles, and who are equally satisfied with him, that they have attained to a knowledge of these principles in the main. We mention this, in order that it may not excite his surprise, if those who attach themselves to no particular party should consider one set of principles as much entitled to their regard as the other, and should withhold from both, at present, their unlimited confidence. We should be sorry to be thought to offer any opposition to those which Mr Swainson advocates. We simply wish to see them better substantiated, than, in our opinion, and, we believe we might add, in that of a large proportion of the naturalists of this country, they are at present. With respect, in particular, to the law of circular affinities, it is undoubtedly true, that many groups, which have all the appearance of being natural, evince a decided tendency to such an arrangement, and, reasoning from analogy, it seems highly probable that this principle may extend throughout nature; but let us investigate the affinities of animals more closely, of those especially, which, being low down in the scale of organization, have as yet obtained but slender attention from naturalists, before we consider this point as resting upon anything like "*mathematical certainty.*"—In fact, the supposed proof of this principle is involved in the fate of two others:—that which assigns a definite number of subordinate divisions to each group,—and that upon which depend those symbolical representations of which we have before spoken.—The whole theory may, in short, be said to rest upon relations of analogy conforming to an apparent law, these relations themselves, however obvious in certain cases, being, when remote, so obscure as to be hardly palpable, when very near, so striking, that, according to Mr Swainson's own shewing, there is danger of confounding them with relations of affinity.* We would not willingly assert, that Mr Swainson has suffered his own judgment to be warped by an active imagination. But certainly we must say, that some of the relations which he has pointed out are such as we conceive few besides

school, either in his Treatise on the "Rise and Progress of Zoology," (Prelim. Disc. part 1.) or in a subsequent Treatise on the "Rise and Progress of *Systematic* Zoology;" (Classific. of An. part 2.) We are inclined to think that the Germans are equally strangers to the school founded in England by Mr Macleay, since we find M. Agassiz adverting to the "philosophic naturalists" of Germany, as those who *alone* have sought after *general* principles.—See Notices of Com mun. to the Brit. Assoc. 1835, p. 67.

* Speaking of analogical relations, Mr Swainson observes;—"In proportion as groups approximate, other dissimilarities of course become less, so that when we descend to genera which follow or come very close to each other, it is impossible to decide, at first sight, whether the relationship be one of analogy or of affinity."—Prelim. Disc. &c. p. 215.

himself can distinctly appreciate; that, at any rate, points, with respect to which there exists any ground for difference of opinion, can hardly be advanced in proof of a theory, whatever there may be to render that theory *probable*.

In fact, we believe the time is not yet come, in which it is possible to *demonstrate* the truth of any theory whatever. We may shew the apparent influence exerted by certain principles which seem capable of being deduced from the data already in our possession; but we conceive that we must be more acquainted with the structure and affinities of animals, before we can establish such principles upon a sure basis. Nevertheless, we would not discourage persons from making the attempt. We are rather inclined to let all naturalists hold their own opinions on this subject, convinced that truth will work its way in the end, and that, if not found in exact agreement with what they had anticipated, it will at least have received some light from their researches.

In the meanwhile, those who keep aloof from speculations of the above kind should endeavour to enlarge the bounds of our positive knowledge as regards this science. Let them investigate some of those departments, to which so little attention has been as yet given, and try to place the several ramifications of the great system of nature upon a more equal footing. By so doing, they will supply sound materials for such as choose to speculate upon the exact plan on which that system is constructed, at the same time that they help the science forwards to that point, which, when arrived at, the plan will in some measure develop itself. For it should be remembered, that there are two distinct objects to be attained, as regards the natural system:— "first, the arrangement of all animals according to their true relations; and then the discovery of those general principles (assuming that there are such) by which these relations are governed."* Now had we already effected the first of these objects, which can only be the result of a rigid analysis, extended to all the groups of animals with which we are acquainted, we should probably have little difficulty in evolving the latter. At present, however, this has been but very imperfectly done. And, perhaps, we are more likely to proceed rightly in this matter, when we go to work unfettered by any theoretical views, which in our anxiety to uphold, we are liable to have our judgment biassed to a degree to which we ourselves are totally unconscious. It is, undoubtedly, at all times agreeable to true philosophy to ascend by inductive reasoning from known facts to general

* The above passage will be found nearly similar to what Mr Swainson has expressed at p. 200 of his Preliminary Discourse.

principles: It is undoubtedly allowable, without waiting for the acquirement of all possible facts that can be obtained, to try any theory which explains those already in our possession, by applying it to such as may be observed afterwards. But the danger is, in the science now before us, especially when we have to deal with analogical relations, that we *mistake for facts*—points, which may certainly appear as such to us, but which are of that nature that they *must* infallibly strike different observers in different lights according to the impressions upon the mind at the time of viewing them. Hence it is that we conceive, that we are more likely to see these relations truly, when we have no theory to support;—when there is nothing which is likely to warp our judgment. We believe that if we made it our first endeavour to arrange all animals according to their best ascertained affinities, at the same time noting any other less obvious relation; and if we then drew lines of separation between such groups as appeared well characterized, taking care to assign to each a rank proportioned to its true value; we should gradually arrive in this manner at as just a conception of the true order of nature as, perhaps, it is possible to attain. * For, after all, it becomes a question, whether, assuming that there is some definite plan in nature grounded upon fixed principles, we can ever hope to understand more than part of it. When we consider how much is requisite to complete the history of a single species, and that we need to be acquainted with this history, not only in the case of all existing animals, but of all lost ones also,—we may conceive how vast must be the task of tracing the relations which one species bears to the others. We can scarcely do more than make some approximation to the truth.—We can only arrange our groups in such a manner, that there be no other known ones more nearly allied to be brought in between those which stand next each other. And the system which does this may be called natural, † although it may not

* The above will be found nearly in accordance with Lamarck's judicious observation on this subject, which it may be well to repeat here. He says,—"Nous avons senti que, pour réussir à établir une bonne *distribution* des animaux, sans que l'arbitraire de l'opinion en affaiblisse nulle part la solidité, il était nécessaire, avant tout, de rapprocher les animaux les uns des autres, d'après leurs rapports les mieux déterminés; et qu' ensuite, l'on pourrait, sans inconvénient, tracer les lignes de séparation qui détachent les masses classiques, ainsi que les coupes subordonnées, utiles à établir, pourvu que les rapports ne fussent nulle part compromis par la composition et l'ordre de nos diverses coupes."—Hist. Nat. des An. sans Vert. (2d edit.) tome i. p. 285.

† This remark is Cuvier's but we are unable to refer to the exact place in which it is expressed.

serve to elucidate all the laws by which the exact plan of nature is regulated.

We would here briefly remind those who enter upon the investigation of the natural affinities of animals, of the importance of being guided by certain acknowledged principles,—quite independent of those general laws above alluded to, indeed independent of all theory whatever, and equally deserving our regard, whether we incline to any theory or not. They respect the *value of organs* and the *subordination of characters*. Except we set out in our enquiries with some definite ideas on these points, we shall be perpetually falling into error. In order to discover the true affinities of animals, it is not sufficient that we compare their respective characters,—and then note what marks of resemblance are to be traced between them :—we must first ascertain what is the relative value of the different organs, which furnish those characters. And how is this to be determined?—By observing which organs exercise the most important functions, or are of most general occurrence. It will be found on such an enquiry, that some appear to take the lead of others,—that while some are constantly present, others are often wanting,—and that even among the former, we may trace, in different instances, very different degrees of variation. Now by paying regard to these circumstances, we establish gradually that subordination of characters, to which we have before alluded as first employed in this science by Cuvier, and which must be the basis of all natural classification. Our limits will not allow us to enter at any length upon this subject, or we might advert to certain rules, founded—partly upon observed facts—partly upon common principles of reasoning, which have been drawn up with reference to these enquiries, and which ought to be well studied by the Zoologist. * We regret, indeed, that, in some instances, they have not been more attended to. Had it been otherwise, we should not see so many conflicting opinions respecting classification ;—we should not see groups of very unequal value placed exactly upon the same footing,—genera founded upon the most trivial distinctions, and such

* Many of these rules apply equally well, or with some slight modification may be made applicable, to the two sciences of Zoology and Botany. On these grounds, we strongly recommend to the attention of naturalists some portions of the Théorie élémentaire de la Botanique of M. Decandolle, where they are laid down with more clearness and precision than in any zoological work with which we are acquainted. The student, however, may consult with advantage the seventh part of Lamarck's Introduction to his Hist. Nat. des. An. sans Vertebres, divesting it of those peculiar theoretical views which pervade the whole of that volume.

as are connected with no peculiarity whatever of habits or economy,—in short, so little attempt made to ascertain the limits of variation in the case of those characters to which recourse is had for the purpose of systematic division. There is one observation in particular we would wish to make, the truth of which must be apparent to all who have paid the least attention to the structure of animals; and that is,—that organs of the same kind, and performing exactly the same functions, do not necessarily afford characters of the *same* value in *different* groups. This circumstance has been much overlooked. We not unfrequently see naturalists taking as the basis of their arrangement a system of organs, which, in certain classes, are universally allowed to be of the first importance, but which, in the group under their consideration, are subject to such modifications, as clearly indicate the subordinate influence which they exert over the economy. We might point out several instances in which this error shows itself. We shall, however, content ourselves with referring to the *pulmonary* and *trachean Arachnida*, which have been made distinct classes by some naturalists, on the ground of differences in their respiratory organs, which they would seem to think entitled to as much regard in the case of the Annulose animals, as all allow them to deserve in that of the Vertebrate.

The subject of the value of characters is closely connected with a question of great importance, and which, in the present state of the science, calls for particular investigation. What are the limits of variation assigned to *species?* We conceive this to be a problem, to which, in these days, we shall do well in directing the attention of naturalists. We need hardly say how general has been the complaint of late years, that species are now multiplied to an excess, quite overwhelming to those who wish to enter into the details of the science, and bidding fair in time to exhaust all the resources of a pure and correct nomenclature. It is undoubtedly true, that to distinguish and point out even the slightest variation of character in animals is of importance, not merely as helping others to identify those which have been the subject of our observation, but as a necessary step to a knowledge of their true affinities. We are, however, only half completing this matter, if we stop there, without proceeding to enquire whether these variations are due to a specific difference, or whether they may have resulted from the action of external or other causes. The evil above alluded to has taken deep root enough in our own country; but in Germany it would seem to have attained to a yet greater pitch. M. Brehm, an ornithologist well known for the extent to which he has multiplied the birds of Europe, a few years back

attempted to establish no less than *seven* species of *Loxia*, or true Crossbill, as natives of Germany.* The same observer has made three species out of *Columba livia;* three out of *Emberiza nivalis;* two out of *Anas glacialis;* two out of *Larus marinus;* the same out of two other species in that genus; two out of *Procellaria glacialis;* besides many more which it would be tedious to enumerate. When we find opinions of this nature entertained, and we imagine it would not be difficult to adduce similar examples in the other departments of Zoology, can we believe that due attention has been paid to those variations of character, which we see constantly arising from local or accidental circumstances in other species, and which in these last we can indubitably trace back to such causes only? With respect to birds in particular, we cannot be too cautious how we place reliance upon mere variations of plumage; over which we know so great an influence to be exerted by age, sex, season, and have ground to suspect, in certain instances, also by climate. We know, moreover, that some of the changes arising from these causes are themselves liable to irregularity from any accidental circumstances affecting particular individuals. This is especially the case with those due to differences of age, as has been proved by rearing birds in confinement. It has been observed that, under such circumstances, an interruption often takes place for a longer or shorter period, possibly in some few instances an entire suspension, of laws, which would otherwise operate uniformly for each species respectively. Thus it is mentioned by F. Cuvier,† that *Gulls*, which in a state of liberty would naturally mature their plumage at the end of the second or third year, have been known in captivity to require one or two years more for that purpose. Analogous facts have been observed in our own country. With respect to the influence of climate in bringing about a permanent difference of character in certain species, as compared with the same species found in other latitudes, it is a subject upon which little positive information has been yet obtained. We may, however, fairly contend that the thing is possible, if not highly probable, till some direct arguments be adduced against it. Assuming, as a fact, that season and temperature cause periodic changes in the plumage of some species; it seems highly probable, that any thing which occurs to disturb the regularity of the seasons or to affect their general character, may affect, in like manner, the regularity of such changes, or at least modify the extent to which they are carried. Now any particular season departing from its usual character in this manner, may

* Bull. des des Sci. Nat. 1828, tom. xiv. p. 259.

† Ann. du Mus. tom. xi. p. 285.

exhibit, while it lasts, the *permanent* character of a distinct climate, in which may occur the same species of bird with its plumage, consequently, from the action of that climate, *permanently* modified. We regret that, in relation to this subject, we have it not in our power to consult a memoir which is said to have been presented nearly two years since, by M. Gloger to the Berlin Academy, treating expressly on the modifications induced by climate on birds. We may, however, quote a remark by M. Jacquemin, which leads us to think that the above idea is far from problematical. He says, in allusion to M. Gloger's memoir, that its author "has demonstrated in such a manner as to leave no doubt, that individuals of one and the same species of bird present different arrangements of colouring according to the climates which they inhabit, and that one and the same individual, amongst the birds of passage, changes during nearly the whole year the colours of its plumage, according to the different climates through which it passes."* If this be true, the question is, indeed, nearly at rest. Or it is reduced simply to an inquiry into the *amount* of influence produced by such a cause; and till some endeavour has been made to assign the limits, the fact itself may well make us sceptical respecting many of the species found in distant latitudes, which, although presenting *the closest affinity* to some in Europe, have been considered as distinct by naturalists.†

We have dwelt so long on the above subject, that we can hardly pursue the question first adverted to, as regards the limits of species, through any of the other classes. In some of these, we may observe variations not of colour only, to which, in the case of birds, such variations are generally restricted, but, to a less extent, of form and sculpture also, which may be due to causes of which as yet we understand little or nothing. Generally speaking, differences of this nature are more to be depended upon than those of mere colour; but even these cannot always be trusted as indicating a distinct species, until after examination of a large number of individuals. We shall then see how far such variations retain their constancy; and whether there may not be found specimens of an intermediate character serv-

* Ann. des Sci. Nat. 1834, tom. ii. p. 279.

† These allied species have been considered different, principally on the ground of their inhabiting such different geographical positions. But there is reason to believe that too great importance has been attached to this circumstance, and that the power of acclimation possessed by many birds is more considerable than naturalists are inclined to suppose.—See a few remarks on this subject, accompanied by a list of Birds common to various parts of the world, by Lieut.-Col. Sykes. Notices of Commun. to the Brit. Assoc. 1835, p. 69.

ing to connect the more extreme cases, and thus clearly proving all to be of one species.

From experiencing the great difficulty which attends the exact discrimination between species and varieties, especially in certain groups in which variation of character is very frequent, some have imagined that there was nothing definite or constant in species themselves, but that they passed insensibly into one another. To this opinion, although embraced by many eminent naturalists, we are strongly opposed. It may be true that hitherto no definition of a species has been brought forwards which will meet all cases; but until our means of observation shall have been more extended than they have at present, this simply proves the imperfect state of our knowledge on this subject. For let us consider how much is wanted to enable us to fix such a definition with certainty. It has been observed with reference to this point, that "we ought to see species in all their several localities from north to south; to get together all the varieties of age, form, colour, and size, in order to construct from all these modifications a table representing one well-known species, and to establish as many of these tables as there are true species of organized beings. By these means we should probably arrive at some law which would fix the limits of the species in its modifications, and serve consequently as the basis of an exact definition."*

Having brought our remarks to this point, we shall simply, before concluding, say a few words for the direction of those, who may be entering on the branch of science we are here considering. We have more than once alluded to the immense field which Zoology brings before us. We have also noticed the great partiality shown by naturalists towards certain parts of that field in preference to others. Now what we would recommend to such as really desire to advance its progress,—is,—that they restrict their chief attention to some given department, and, when practicable, to those particular groups which have been least studied. It is utterly out of our power to become acquainted with all the existing species of nature. The longest life, added to the enjoyment of the most favourable opportunities, will not suffice for acquiring more than a very limited knowledge of the details of their history. It must, then, be by division of labour, that we try to perfect the science, so far as human researches can perfect it. We must bring our observation to bear on those parts of it which are behind the others,—we must apportion such parts amongst us according to the respective circumstances in which we are placed, and

* Lam. Hist. Nat. des An. sans Vert. (2d edit.) tom. i. p. 166.—Note by the Editors.

then, by combining afterwards the results obtained separately in this manner, we may one day be in a position to form some judgment of the true natural system. But, before selecting our particular field of observation, it is very desirable that we take, as far as possible, a general view of the whole subject. This is requisite, in order that we may get some idea of that uniformity of plan which pervades more or less the entire animal kingdom, and of that complicated chain of affinities by which its several divisions are held together. Hardly any group is circumscribed by such absolute boundaries, as to admit of being viewed correctly, except in connection with all others to which it bears any kind of relation. It may not be necessary to study these others in detail, but without some knowledge of them, we shall hardly prosecute successfully our own department. Except we have some acquaintance with other structures, we shall hardly set a right value upon those modifications of structure which come before us; and except we see something of the affinities of other animals, we shall hardly arrange according to their true relations those with which we are concerned. We shall especially overlook those approaches to the organization of contiguous groups by which is effected a passage from one to another, and those partial resemblances, or relations of analogy, which may be so often (some think always) traced between corresponding parts of two parallel series.

With respect to the particular groups, which, in the present state of the science, call most loudly for the attention of naturalists, we can only make a few remarks, supplementary to those which we have already made elsewhere.* We would observe, generally, that it is towards the bottom of the system that their exertions are most wanted. We as yet know but little of the classification of the *Invertebrate* animals, below the *Mollusca* and *Annulosa*. We may think that we can, with some appearance of truth, point out the leading divisions, or even proceed to the arrangement of the more subordinate groups; but every day is bringing to light some fresh discoveries calculated to make us mistrust those views which are founded more upon *a priori* reasoning than upon actual observation. We are so in ignorance of the real structure of certain families; we find others established upon characters of general resemblance, but offering internally such differences of organization;—that we can hardly say at present, with reference to these animals, on what systems of organs we can most rely as the basis of a natural classification, or indeed, in many instances, what organs are present. It is a question of dispute at this moment,

* Report on Zoology, p. 249.

whether those microscopic marine shells, which have been hitherto arranged with the *Cephalopodous Mollusca*, and in which class they stand as D'Orbigny's order of *Foraminifera*,—whether, after all, they do not belong to animals possessed of the very simplest organization, and such as brings them into close alliance with some of the lowest forms among the *Infusoria* of Muller.—Such at least is the opinion of M. Dujardin, whose memoir on the structure of these animals, published recently, is deserving of attention.* The same observer has been led by his researches to question the accuracy of even the brilliant discoveries of Ehrenberg with respect to the *Polygastrica*. He is inclined to think that the supposed alimentary sacs seen by that naturalist are simple vacuities formed spontaneously in the midst of a peculiar gelatinous substance† which enters into the composition of these animals, and through which the water is imbibed into these vacuities. He considers the existence of a mouth and anus as a mere illusion. Whether these opinions be right or not, they show that our knowledge of the structure of these groups, which is the only sure guide to their classification, is not yet upon a sure footing. And how many others are there to which the same remark is applicable? We might speak of the *Physaliæ*, by some classed with the *Acalepha*, by others with the *Mollusca*;‡ or of the *Diphyæ*, those anomalous beings which we are at a loss whether to consider as simple or compound animals. We might allude to the strange discovery, recently announced by Mr Thompson,§ that the genus *Comatula* is, during its young state, a species of *Pentacrinus*, to shew that even in tribes with whose structure we are better acquainted, there is yet much to be learnt as regards their history. Or, lastly, we might dwell on those extraordinary productions, which seem to baffle all our conjectures respecting their true nature;—which we know not whether to arrange with plants or animals, and which some have even regarded as forming an intermediate kingdom between the two.‖ Who does not see, in these instances, and in many others which might equally be brought forward, an ample and almost untrodden field, in which the acquisition of only a few facts may lead to the most important discoveries.

* See Ann. des Sci. Nat. 1835, tom. iv. p. 343.

† To this substance, which is said to be found in all the lower animals intermixed with the other elements of their structure, M. Dujardin gives the name of *Sarcode*.—See Ann. des Sci. Nat. 1835, tom. iv. p. 364.

‡ Referred to the *Mollusca* by Blainville.—See his Manuel d'Actinologie, (1834,) p. 112.

§ Edin. New Phil. Journ. No. 40, (April 1836,) p. 295.

‖ See the article Arthroidees in the Dict. Class. d'Histoire Naturelle.

We are not without hope that the above and other obscure tribes of animals, which have of late years attracted much notice from a few eminent observers, will continue daily to be brought more to light. We would also hope, that as there are already some in our own country who have devoted themselves to these departments, there will not be wanting others to join in the inquiry. The shores of Britain offer great advantages for the study of the marine *Invertebrata*. Those, especially, who are resident on the coast, have it in their power, not only to examine these animals in a recent state, but to follow up a series of observations on the same individuals, so as trace with accuracy the successive changes through which they pass before attaining to maturity. There are, however, many groups inhabiting fresh water not less deserving the attention of the inland naturalist. The field may be here more limited, but it is still extensive. Our rivers, streams, and ditches, abound with various forms of animal life; of which, if some, belonging to the higher classes, have been well investigated, there are others, low down in the scale of organization, offering a rich harvest to the attentive naturalist. It is here that we meet with the *Planariæ*, so remarkable for their singular modes of propagation;—the *Hydræ*, which have already immortalized one observer;—the *Vorticellæ*, imitating in exact miniature the most elegant forms of vegetable life;—the *Rotatoriæ*, so called from that astonishing mechanism by which they secure their prey, and to which it would be difficult to find anything parallel in other classes. It is here that we have the opportunity of searching into the real structure of the *Polygastric Infusoria:* it is here, especially, that we may investigate, in all their details, those ambiguous productions, to which we have already alluded, as oscillating, if we may so speak, between the two great kingdoms of organized beings.

In expressing a hope that before very long, we shall have much increased our acquaintance with the lower animals,—we have been guided by the circumstance, that many groups are now attended to by naturalists, which, till recently, have been very little thought of. A spirit of inquiry has arisen up amongst us, which is no longer content with treading in the old beaten paths. If Entomology, perhaps the most attractive branch of the science under our consideration, still usurps an undue share of the attention of naturalists, it is at least studied in all its several departments, and with a degree of zeal no longer restricted to the mere desire of accumulating rare specimens. It was observed five years back,* that the *Coleopterous* insects en-

* Bull. des Sci. Nat. 1831, tome 27, p. 102.

gaged alone two-thirds of the European Entomologists. We are inclined to think that there is no longer any ground for such an assertion. Sure enough in this country, whatever may have been the case formerly, it is now otherwise, Judging from the elaborate memoirs which have appeared lately, in illustration of some of the most minute and obscure families in different orders, it would seem as if each order had its own admirers, and as if they were all in the way to a progressive development of their contents. There is further a desire manifested to study certain groups which in bygone days the Entomologist seemed to think beneath his notice; as well as to extend inquiry to all the other classes of the *Annulosa*. We need only refer in illustration of this remark, to Mr Templeton's recently published memoir on the *Thysanura* of Ireland *—to Dr Johnston's on the *Myriapoda* of Berwickshire †—and to sundry memoirs on the *Crustacea* of the British Islands, to one especially on the *Entomostraca* by Mr Baird, ‡ which we believe to be nearly the first attempt that was ever put forward in this country to investigate the native species of this very interesting group. We hail these essays as indicating a very different spirit from that which prevailed amongst us a few years back. They lead us to anticipate the day, in which there will be found no lack of labourers willing to enter upon any portion of that immense field which Zoology presents to us, and which requires to be explored in its very darkest recesses, before we can make much approximation to the exact plan upon which it has been mapped and laid out by the Great Author of Nature.

It is encouraging to those who engage in the pursuit of Natural History, to think—that, however restricted may be their situation or circumstances, however limited their opportunities and means of observation, they have it in their power to do something for the advancement of this science. They have only to direct their researches with care and accuracy, with patience, § with judgment, and with a never-failing regard for truth. Let them do this, and it matters not what department they take up. They may select any group, which they consider as best adapted to their means of study, or to which their inclination prompts them most strongly. It is, indeed, not easy to estimate the advantages that would accrue, if each individual were

* Entomol. Trans. part 2, p. 89.

† Loud. Mag. of Nat. Hist. vol. viii p. 486.

‡ Proceed. of Berwicksh. Nat. Club. p. 95.

§ We have a striking instance of patience exemplified in Ehrenberg, who, we are told, was *ten years* in conducting his experiments, before he succeeded in selecting a fit colouring matter to serve as nutriment for the *Infusoria*.—See Edinb. New Phil. Journ. 1831, p. 209.

to do nothing more than to glean such facts as offered themselves to his notice. * It is observed by the great Cuvier,—that the "natural sciences are but collections of facts, and our theories only formulæ for embracing a large number of them: hence it follows, that the smallest fact, if well-ascertained, ought to be preserved; since if new, it may serve to modify our most approved theories: the most simple observation may overthrow the most ingeniously-constructed system, and open our eyes to a long train of discoveries, which had previously been concealed from view by received formulæ."†

With the above words,—the words of one whose judgment and great experience entitle him to be heard on such a subject, and who himself appreciated as it deserved even the smallest endeavour made to promote the advancement of the particular science we have been here considering,—we would conclude these remarks. It was in conformity with such views that he himself acted. He was not opposed to theory; ‡ but he knew enough to mistrust the theories of his own day, and to see the necessity of knowing more to establish their validity. He sought truth only; and truth is what we also should propose as the end of our researches. We may not all attain to the same brilliant reputation which he earned; or enlarge as widely as he did the bounds of science. But we may do enough to entitle us to the thanks of those who take a common interest with ourselves in these pursuits. We may throw our mite into the common stock. We shall at least reap the satisfaction which never fails to attend the study of Nature; and even if our labours should not conduct to any great or very important results, they will yet have been the means of opening to us an inexhaustible fund of rational occupation and amusement.

Swaffham Bulbeck, April 21, 1836.

* Many facts of great importance relating even to the most common animals, remain yet to be observed. Thus M. Prévost has thrown much additional light lately upon the habits of the *Cuckow*, and shown that, notwithstanding the degree of attention which this bird had received from naturalists, there was yet much to be learnt respecting its anomalous history. See L'Institut, 1834, p. 418. See also an article "on the Importance of preserving Facts connected with the Natural History of Animals,"—by Mr Swainson, in the Lond. Quart. Journ. of Science, (New Series) vol. i. p. 83.

† Hist. des Prog. des Sci. Nat. tome i. p. 5.

‡ It has been well said by M. Laurillard, that "he who, in the introduction of his work on fossil bones, remarked,—*Why may not natural history one day have its Newton?* could not be the enemy of theory."—See some remarks by that writer, in his Eloge on Cuvier, in reply to those who have taunted Cuvier with being a mere collector of facts.—Edinb. New Phil. Journ. vol. xvi. p. 360.

II.—*On the Disunion of contiguous Layers in the Wood of Exogenous Trees.* By Rev. J. S. Henslow, M. A., Professor of Botany in the University of Cambridge.

In his Introduction to Botany, (second edition, p. 267,) Dr Lindley concludes his account of the different theories which have been proposed to explain the manner in which the concentric layers of Exogenous trees are formed, by the following remark: "As this is one of the most curious points remaining to be settled among botanists, and as it is still as much open to discussion as ever, I have dwelt upon it at an unusual length, in the hope that some one may have leisure to prosecute the inquiry." It is very plain that Dr Lindley himself has embraced the theory of Du Petit Thouars, to which also several other botanists of distinguished reputation are equally inclined to assent.

This theory I need not dwell upon, as every botanist interested in physiological speculations is acquainted with it, and as it is fully explained in the work to which I have just referred. But as this theory cannot be considered so thoroughly established by any direct experimental proof, which has placed it beyond all cavil, I propose to examine one class of phenomena which have been considered easily explicable by this theory, but not so readily to be explained by any other which has been hitherto advanced. I allude to the appearances occasionally met with, where the old trunk of a tree is completely invested by the layers of wood composing an outer case or new trunk of the same. In the New Series of the Annales des Sciences, for 1835, (vol. iv. p. 126,) M. Meyen notices an observation of M. Wiegmann's to this effect: "L'observation d'un tronc de Saule mort au milieu d'un tronc vivant est très intéressante; ce phénomène a été observé par Lindley sur un Peuplier et s'explique bien par la théorie de Du Petit Thouars." This allusion to Dr Lindley refers to a paper of his in the Journal of the Royal Institution for May 1831, where he gives a description of a poplar apparently presenting the "singular anomaly of one tree growing within another."

My own attention was more particularly directed to this account about three or four years ago, upon meeting with a parallel instance; and since then I have been on the watch for other examples which might tend to throw further light upon the subject. The result of my inquiries has satisfied me that this phenomenon does not afford any direct evidence in support of the theory of Du Petit Thouars,

but that it may be explained in a simple manner independently of that theory.

I possess a specimen strikingly similar to that described by Dr Lindley. It consists of about two feet of the trunk of a poplar six inches in diameter, which has been split longitudinally. In the centre is exposed the earlier state of this trunk, when it was about two inches in diameter, and the want of union between this central portion and the surrounding layers is complete. Upon the inner trunk (as we may call it) are the stumps of some pruned branches quite as distinct as in Dr Lindley's specimen. The wood of this inner trunk is sound except for some distance along its surface, on one side only. At the lower extremity of the specimen the layers of the outer trunk are regularly formed, being concentric with those of the inner, and possessing every appearance of having been deposited in the usual manner; and a transverse section would not have exhibited any want of organic union between the two trunks. But at the upper extremity, the layers of the outer trunk are not so regular. Those which lie next the inner trunk, instead of being continuous, are interrupted and curved inwards (FIG. A.) exactly as we see them in all cases where a wounded surface has become coated over with fresh wood. A patch of bark is enclosed between these layers and the inner trunk, and it is on this side that the surface of the latter is partially decayed. In short, the appearance is precisely that which would be presented if one side of the trunk had died whilst the other continued to grow, and spread gradually over the dead portion; and I cannot but conclude that such has really been the case, notwithstanding this want of organic connection between the inner and outer trunk. This want of union, therefore, does not arise from the death of the inner trunk previously to the deposition of the layers which are formed round it, as Dr Lindley supposes to have been the case in his specimen, but must have resulted from the action of some cause subsequent to the formation of the layer in immediate contact with the inner trunk, which layer may therefore have been deposited in the usual manner; without the necessity of our having recourse to the explanation afforded by the theory of Du Petit Thouars. In fact, according to Dr Lindley himself, this theory only explains the formation of the vascular portion of the layers, it being allowed that the cellular portion arises from a lateral development of this tissue in the

FIG. A.

older layers. It may readily be conceived that the excessive pruning, to which it is evident that Dr Lindley's poplar and my own specimen were subjected, might prevent the wood of that year's growth from becoming fully matured, and thus the connection between it and the next layer might be so slight as to admit of their being readily detached after the latter had become fully indurated. This separation would be further assisted by the numerous surfaces of the pruned stumps, since no union whatever takes place between the older wood thus exposed and the new wood which forms over it, the very marks of the knife, which may happen to be on it when imbedded, will be accurately preserved. But independently of the cause, whatever it may be, which has operated in producing the separation between the inner and outer layers of these specimens, it is by no means uncommon to find examples among the succulent branches of such wood as the willow, possessing a loose texture, where a slight degree of violence is sufficient to separate two contiguous layers, and I have found similar instances in large and dry branches of the elm. I possess a very good example from this latter tree, produced by the violence of the concussion with which a branch struck the ground when the tree was felled. The shock has detached some of the outer layers towards the extremity of the broken branch, and has thus left the inner layers exposed for some length, and exhibiting the perfect form which the branch possessed when it was much younger. (See FIG. B.)

FIG. B.

In the specimen of poplar which I have described, the inner trunk has not become so much contracted in drying as the surrounding layers, probably from its having been longer dead and more thoroughly seasoned; and the consequence is, that its extremities project beyond the truncated surfaces of the others. This fact points to another cause which may probably assist in disuniting two contiguous layers, since one portion of the trunk may die and either contract or expand more than the other.

The phenomenon we have been examining may be considered analogous to the growth of new wood round a decayed or hollow interior, or perhaps still more closely to the partial destruction of a newly formed layer by frost. A transverse section exhibits such a dead layer blackened and decayed, lying between two layers of sound wood.

In stating my opinion of the manner in which we may explain the phenomenon of a "tree within a tree," without the necessity of referring to the theory of Du Petit Thouars, I do not wish to be understood as asserting this theory to be incorrect. If it is to stand, it will doubtless be one day established upon clear and conclusive experimental proof; but in the meantime it is right for us to be cautious in admitting the explanation of any phenomenon upon the supposition of the theory being true, which may as easily be accounted for upon other and well established principles.

III.—*The Natural History of the British Entomostraca.* By William Baird, Surgeon.

There is no order of insects to which so little attention has been paid by the naturalists of Great Britain, as the *Entomostraca*, and there are few, if any, that are more deserving of attentive study. The external appearance of these little interesting creatures, viz. *insects* enclosed in a *testaceous covering*, is enough of itself to excite the curiosity, and rouse the interest of the naturalist. A great number of them, indeed, are so like shells, that a person ignorant of the *inhabitants* would not fail at first sight to call them so;* and the very singular phenomenon of animals belonging to the class of insects, being so covered with a shell, has supplied to Müller the name of *Entomostracon*, a term derived from two Greek words, signifying "an insect with a shell;"† a name which this order of insects has hitherto maintained, and which has been almost universally adopted by naturalists from Müller's time to the present day. Previous to the appearance of Müller's work, the few species which were known, were arranged under one genus, the genus Monoculus—and they were so called from their possessing, or appearing to possess, only one eye. Schœffer appears to have proposed the name of *Branchiopodes* for them, from their feet possessing branchial appendages; and Müller says he would have preferred this name to that of Monoculus, were it not that several species wanted these organs. The species, however, which he mentions are either the Nauplii and Amymones, not aware that these were but the imperfect young of the genus Cyclops, or the Cythere, which possesses branchial appendages attached to the jaws instead of the feet. These facts, however, he was not aware of, and therefore he preferred to either of the above names, that of Entomostracon,—a name which I

* Müller. † Entomostraca, p. 2.

have said above has been retained by almost all succeeding authors, though most of them have applied the term Branchiopodes to some particular division of them. Linnæus only describes nine species in his *Systema Naturæ*. Seven others, however, had been figured by the microscopical observers, Joblot, Baker, Frisch, Geoffroi, and Ledermüller, while a few others had been added by the celebrated Ströem, Goeze, and Herbst. * Of all the earlier writers, however, the illustrious De Geer has perhaps given the most interesting memoir upon these insects.† He describes at length and figures most accurately seven species, and adds to the description some exceedingly interesting details. He seems to been aware of the transformations of the Cyclops, and has given pretty accurate figures of the young, though unfortunately he was not able to follow up his observations, and trace the final change into the perfect animal; which has since his time been so ably done by Ramdohr and Jurine, apparently without knowing of each other's discoveries. Leeuwenhoek also noticed the great difference between the young and old of these little animals, but did not follow up his observation either. Swammerdam and Schœffer have given a good many details with regard to some species of the Entomostraca; but though much interest may be derived from a perusal of the writings of these different authors, still it is to the celebrated Danish naturalist, Otho Fridericus Müller that we are most indebted. To him we owe the collecting the various species already made known, into one memoir—the arranging them into distinct genera and species,—many important and exceedingly interesting details with regard to them, never before made known, and the addition of an amazing number of new species, which that zealous naturalist discovered in the fresh waters, and on the sea coast of Denmark and Norway. He may be called the first regular historian of these insects. To him it is that we owe almost all our knowledge with regard to them; and to his eloquence is perhaps owing the further researches and more detailed histories of succeeding naturalists. His work on the Entomostraca, published in 1785,‡ is one of the most interesting memoirs in natural history that we are acquainted with; and though it appears from later naturalists, that he has fallen into several errors, still it is the most complete and the best history of the Entomostraca that has ever been publish-

* Müller.

† Mémoires pour servir à l'Hist. des Insectes, tome vii. Mem. 7. (French edition. Stockholm, 1778.)

‡ Entomostraca, seu Insecta testacea quæ in aquis Daniæ et Norvegiæ reperit, descripsit et iconibus illustravit Otho Fridericus Muller. Lipsiæ et Havniæ, 1785, 4to.

ed. Since the time of Müller, much has been done by our Continental neighbours to add to our knowledge of these interesting little creatures. The works of M. Jurine, the father,* and Ramdohr,† have especially been successful in extending our acquaintance with the anatomy and economy of the Branchiopodes, but unfortunately their works are scarcely to be had in this country. The memoirs of M. Straus,‡ upon the genus Daphnia and Cypris, contain the most excellent and most minute histories of these two genera, that can be met with; and his researches, having been conducted with the greatest zeal and care, leave little to be done with regard to them by succeeding naturalists, but to add to the species. Jurine, (fils,)§ Daudebart de Ferussac, (fils,)‖ Adolphe Brogniart,¶ Hermann, (fils,)** M. Prevost,†† and MM. Milne-Edwards and Audouin,‡‡ have each contributed excellent memoirs on detached genera and species, and greatly enlarged our knowledge of the history of a number of curious and most interesting animals.

Whilst the Continental naturalists have been thus earnest in studying the Entomostraca, it is curious that no British naturalist that we know of, with the exception of the celebrated Dr Leach, has paid any attention to them. The memoirs of this excellent naturalist, with the exception of two,§§ are for the most part scattered over various French periodicals, and are chiefly directed to the history of some of the parasitic animals belonging to the division. In his article Crustacea, in the Edinburgh Encyclopædia, he only enumerates sixteen species as found in Great Britain, a list which is increased by Samouelle in his "British Insects," to the number of twenty; and

* Histoire de Monocles qui se trouvent anx environs de Genéve. Genéve, 1820, 4to.

† Materiaux pour servir à l'Histoire de quelques Monocles de l'Allemagne.

‡ Memoires du Museum d'Histoire Naturelle, tome v. and vii.

§ Memoire sur l'Argule foliacé. Annales du Museum d'Histoire Naturelle, tome vii. p. 431.

‖ Memoires sur deux Nouvelles espéces d'Entomostracés. Ann. du Mus. d'Hist. Nat. tome vii.

¶ Memoire sur un Nouveau genre de Crustacés (Limnadia.) Mem. du Mus. d'Hist. Nat. tome vi.

** Memoires Apterologiques, folio, Strasbourg, 1804.

†† Memoir on the Chirocephalus, in the Journal de Physique, tome liv., at the end of Jurine sur les Monocles, &c.

‡‡ Annales des Sciences Naturelles, tome ix. 1826. (Memoir on the Nicothoe.) Memoir on the Structure of Mouth in Siphonostomous Entomostraca, Ann. des Sciences Nat. tome xxviii. 1833.

§§ Supplement to Encyclopædia Britannica: Edin. Encyclopæd. Art. Crustacea.

we are not aware of the catalogue having been much increased since the publication of this latter work. It surely is not from want of interest belonging to them, that the naturalists of this country have so neglected these curious little animals, for many of them are worthy of all admiration. "The multifarious and complicated structure of their body," says Muller in his admirable work,* "the wonderful agility of their members; the very great fineness of their organs; their singular method of living and copulating; their living in waters which our cattle and we ourselves are daily drinking; the evils which they may give rise to, and which are seen to be inflicted on fishes; the emoluments, which, although we are in the greatest part ignorant of them, they nevertheless produce in the economy of nature;† that these things are very worthy of being known, scarce any one will doubt. Not to mention their external similitude to shells, and the natural transition which takes place in them, from insects to testaceous animals, who ever knew, before the Cypris was detected, of an insect quadruped? Before the Limulus and Caligus were properly observed, who ever knew of an insect acephalous, or with a head at least scarcely visible? Who ever imagined of a copulation of two males with one female at one time, such as takes place in the famous *Pulex aquaticus?* Or of an animal whose head was all eye, as we see in the Polyphemus? These and more wonders are to be met with in the history of the Entomostraca."

The systematic arrangement of the Entomostraca has been a matter of considerable discussion amongst naturalists; and has varied much according to the various views which authors have adopted. Desmarest, in his work on the Crustacea, published in 1825, has given a tabular view of the various arrangements which different authors have suggested, from Linnæus to his own time. In the last method adopted by Latreille in the fourth volume of Cuvier's *Règne Animal*, published in 1829, the following is the arrangement, and in it are, I believe, embodied almost all the genera introduced by his predecessors. Of the great class "Crustacea," he forms two general divisions, the "Malacostraca," and "Entomostraca." The Malacostraca he divides into five orders, "Decapoda, Stomapoda, Amphipoda, Læmodipoda, and Isopoda;" the Entomostraca, into two, the "Branchiopoda and Pœcilopoda." The order Branchiopoda contains those genera which have organs proper for mastication, are possessed of branchiæ attached to the feet or jaws, and are,

* P. 4.

† "It is the common opinion, that it is the Caligi which force the salmon from the sea up rivers towards the waterfalls."

for the most part, enclosed within a testaceous covering, either in the form of a buckler, or that of a bivalve shell. The second order Pœcilopoda embraces those insects which are not provided with organs proper for mastication, and are almost all parasitical, living upon fishes and other aquatic animals. The first order, the Branchopoda, is divided into two principal sections, the "Lophyropa and Phyllopa." The first of these again is subdivided into three very natural groups or families, the "Carcinoida, Ostracoda, and Cladocera;" while the second is subdivided into two. The Pœcilopoda, on the other hand, is composed of rather heterogeneous materials, and many of the genera approach very much to the "Lerneæ," though, according to Latreille, the presence of eyes, the faculty of changing their skin, or even of undergoing a species of metamorphosis, and the power which they possess of transporting themselves from one place to another, by means of feet, establish a positive line of demarcation between the Pœcilopoda and Lerneæ.* The arrangement above-mentioned has, since 1829, received from its accomplished author, some modifications, which he published in 1831, in his "Cours d'Entomologie," but which I have not seen. The last writer upon the Crustacea, M. Milne-Edwards, in his work, half of which only is as yet published, † has taken perhaps a more philosophical view of the subject, and has proposed the following arrangement: The great class "Crustacea" he divides into three sub-classes, the characters of which are taken chiefly from the organization of the mouth. The two first of these have an apparatus *especially* provided for the laying hold of the substances destined for their food, while the third has no such special organization, their masticatory organs being the same as their organs of locomotion. The first sub-class is that of the *Maxillés* or those whose mouth is furnished with organs for *mastication*, the second is that of the *Suceurs*, or those whose mouth is furnished with an apparatus for *sucking*, and the third is that of the *Xyphosuriens*, or those whose organs of motion are the same as the organs of mastication, and which differ in many other points also from the two first. The sub-class Maxillés, he again divides into four legions, 1*st*, "Podopthalmiens," containing the orders "Decapodes" and "Stomapodes;" 2*d*, "Edriopthalmes," containing the orders, "Amphipodes," "Isopodes," and "Lamipodes;" 3*d*, "Entomostracés," containing the orders "Ostrapodes," and "Copépodes;" and 4*th*, "Branchiopodes," containing the orders "Cladoceres" and "Phyllopodes." The order

* Règne Animal, vol. iv. p. 147

† Histoire Naturelle des Crustacés, Suites à Buffon, tom. i. Paris, 1834.

Ostrapodes corresponds with Latreille's group Ostracoda; the Copépodes, with his Carcinoida, the Cladoceres, with his Cladocera, and the Phyllopodes corresponds with his second principal section, the Phyllopa. In this arrangement, therefore, the two last legions of the Maxillés, the Entomostracés and Branchiopodes, correspond exactly with Latreille's first order, the Branchiopoda; and form a very natural group; whilst the second order, the Pœcilopoda, is separated altogether from the Entomostraca, properly so called, and correspond with M. Milne-Edwards's sub-classes, Suceurs and Xyphosuriens. This arrangement I shall adopt in the remarks which follow, and my Catalogue of British "Entomostraca" shall thus be confined to Edwards's two legions Entomostracés and Brachiopodes, or Latreille's Branchiopoda.

The animals of this group, when noticed in their native habitats, may be seen to have their branchiæ constantly in motion, their action being seldom interrupted. One chief use, therefore, of these little insects, in the economy of nature, may be, as Muller says,* to ventilate the water day and night; and as they chiefly reside in standing pools, they may thus be of great use in preserving them from becoming soon putrid. As this may be considered one of the benefits conferred by these insects, it may be useful to know the evils to man they may be likely to produce. Though they are most abundant in stagnant water, they yet occur in considerable numbers in the purer sorts of water that serve as our common drink, and may frequently be seen in considerable quantity even in the drinking water of London, Edinburgh, &c.; and Müller asserts very gravely, that, as we thus drink them alive and with their eggs, he would not be surprised were we to discover them some day in the human intestines.† "The time," he says in another place,‡ "is at hand, when the causes of disease shall not only be sought after in the air, in our method of living, &c. but in the incautious use of waters, often abounding in innumerable animalcules." According to Müller and Straus, these insects live upon vegetable matter and not upon animals; and the former, in an experiment he instituted, says,§ that in keeping a number of species, such as the *Daphnia pennata* and *longispina*, *Cypris strigata* and *pilosa*, *Lynceus sphæricus* and *Cyclops quadricornis*, in the same water from the 24th July to the 22d January, during which time the water had evaporated from a depth of five inches to that of one, he frequently subjected small quantities of this water to the microscope, and was never able to discover any animalcules in it upon the most attentive examination, though the intestines of

* Entomostraca, p. 8. † Ibid. p. 33. ‡ Ibid. p. 12. § Ibid. p. 7.

the Entomostraca themselves were seen to be full, sufficiently proving that they had not fasted during that time. This assertion, however, I am much inclined to doubt, at least with regard to some of the species, as I have seen dead specimens of *Cypris*, for example, attacked almost immediately upon their being placed in the water, by quantities of the *Cyclops quadricornis*, who, in a few minutes, had fastened themselves apparently upon the dead animal, and were so intent upon their prey that they were scarcely frightened away from it by being touched with the brush. In a short time the *Cypris* might be seen lying at the bottom of the vessel, the valves of the shell separated and emptied of their contents. Leeuwenhoek and De Geer not only maintain that the *Cyclops quadricornis* lives upon animalcules, but that they also prey upon their own young; a fact which I have also noticed myself. Jurine also asserts that the *Cyclops quadricornis* is carnivorous from taste, and only herbivorous from necessity, while the *Daphnia pennata* he distinctly says lives upon animalcules. When, indeed, we consider the amazing quantity of animals which swarm in our ponds and ditches, and the deterioration to the surrounding atmosphere which might ensue from the putrefaction of their dead bodies, we see a decided fitness in these Entomostraca being carnivorous, thus helping to prevent the noxious effects of putrid air which might otherwise ensue; whilst they in their turn become a prey to other insects which no doubt serve their purposes also in the economy of nature. The fresh water Gammari seem to prey upon them, and the Hydrachnæ are their decided enemies, for, says Muller, "they seize hold of them, when swimming, by their feet, and daintily suck the life's blood out of their captives with their sharp beaks."* "The Hydra also, and not a few aquatic larvæ, lay snares for them, and many Vorticellæ frequently grievously infest them, for they not only adhere, often in heaps, to the members projecting beyond the shell, but also nestling themselves within the shell, they overspread the whole body with their own colonies, not a little retarding the motion and agility of their host."† The transformation which the young of the genus *Cyclops* undergo in their progress to maturity, the changing their skin, not only of the body of the animal but also the whole shell, with various other very interesting details, I shall not insist upon here, but reserve them for a future number under the history of each genus.

(*To be continued.*)

* Entomostraca, p. 8. † Ibid.

IV.—*Notices of British Fungi.* By Rev. M. J. Berkeley, M. A. No. I.

Though the number of British Fungi described in the last volume of the English Flora amounts to nearly 1400, it is remarked in that work, that this is by no means to be considered as more than an approximation to a perfect list of the species indigenous to Great Britain. Indeed many of considerable interest occurred while the sheets were passing through the press, which were inserted in the body of the work, with the exception of a few which are noticed in the list of addenda, and several have lately fallen in my way, which at present are unrecorded, as belonging to the British Flora. It is proposed, therefore, from time to time, after the plan of the admirable communications of a similar description by M. Montagne, in the Archives de Botanique, and the new series of the Annales des Sciences Naturelles, to give detailed descriptions and figures of such as are new or of any peculiar interest, but, as regards those which are well known, mere references to some good authority, with occasional remarks, and indication of the places where they occurred. New localities of the rarer species will also be inserted, and any additional information respecting such as are already recorded. These by way of distinction will be marked with an asterisk.

1. *Agaricus mastoideus,* Fr. Syst. Myc. vol. i. p. 20. Mastocephalus, Batt. Fung. Hist. p. 30. tab. 10. fig. A.—This very interesting and beautiful Agaric occurred sparingly amongst moss, under blackthorn in a wood at King's Cliffe, Northamptonshire, towards the end of October 1835. There can be little doubt that it is identical with the species which Battarra had in view, and which Fries has adopted from his figure and description. Like Ag. excoriatus it is very nearly allied to Ag. procerus, but is distinct from both in its slender habit and papillose scales.

Pileus $1\frac{3}{4}$ inch across, $\frac{3}{4}$ inch high, very strongly umbonate, with a depression round the umbo, subcarnose; epidermis breaking up into small umber papillæ, which are larger and more scattered towards the margin. Gills remote, rather narrow, yellowish. Stem $3\frac{1}{2}$ inches high, slender, strongly attenuated upwards, incrassated at the base, sunk into the substance of the pileus, minutely villoso-squamose, filled within with cottony fibres. Ring deflexed, scarcely moveable. My specimens were rather past maturity, I cannot, therefore, assert positively that the stem in the young plant is so tough as described by Battarra.

Tab. II. fig. 1. *a.* Agaricus mastoideus. nat. size; *b.* vertical section.

* 2. *Ag. pelianthinus,* Fr. Syst. Myc. vol. i. p. 112.—This species,

which appears to have been noticed only by Bolton, occurred abundantly at King's Cliffe, October 1835. The gills are sprinkled over with short purple hairs, like those on the lip of Orchis fusca, which on the edge are arranged in fascicles. Smell strong, somewhat like that of Ag. sulphureus. Sporidia white. Habit approaching to that of some species of the subgenus Psathyra.

3. *Ag. rubidus*, n. s.—Amongst mosses on the mould of a pot containing a foreign Polypodium, consisting of peat and sand, in a hothouse at Milton, Northamptonshire, March 1, 1836.

Pileus $\frac{1}{3}$ inch broad, convex at length umbilicate, the margin sometimes slightly wavy membranaceous, finely silky white or grayish, acquiring at length a pale ruddy tinge. Gills broad, ventricose, adnate, with frequently a more or less distinct tooth, in consequence of which they are sometimes at length decurrent, rose-coloured, as far as I could observe not clothed with any spiculæ. Sporidia rose-coloured, elliptic. Stem $1\frac{1}{2}$–2 lines high, thickest above, white or grayish like the pileus, quite solid, minutely silky. Smell like that of new flour.

This species belongs clearly to the subgenus Eccilia of the second series Hyporhodius, and is quite distinct from all described by Fries.

Tab. II. fig. 2. *a*. Ag. rubidus, nat. size; *b*. vertical section of three states, do; *c*. Sporidia highly magnified.

* 4. *Ag. glaucopus*, Schæff. Fr. Syst. Myc. vol. i. p. 224.—The plate of Sowerby referred to by Persoon and Fries for this species, belongs rather to Ag. callochrous, *a*, and in consequence the description given in the English Flora, which was made with an especial view to it. The true plant, which occurred at King's Cliffe, at the end of October 1835, is one of the finest of our Agarics.

* 5. *Ag. speciosus*, Fr. Obs. 2. p. 1.—Since the account of this species was given in the Addenda to the English Flora, I have seen Letellier's Supplement to Bulliard, which contains at t. 623. *a*, (under Ag. volvaceus,) and t. 645, figures of Ag. gloiocephalus, D. C. His figure accords precisely with the plant I have in view, except that there is no indication in it of villosity on the stem and volva, but, as it appears to me, there are no characters to distinguish it from Ag. speciosus. The volva is by no means obliterated, the stem not equal, but always more or less attenuated upwards, and sometimes even bulbous, and one of the specimens is almost four inches broad. The peculiar manner in which the volva passes under the stem is also the same.

6. *Polyporus cinctus*, n. s.—On a very rotten plank from an old house, King's Cliffe.

The first growth of this highly curious species consists of small erect scattered tufts of radiating strigose fibres, somewhat resembling those which clothe the pileus of Pol. vulpinus and its allies, but finer. Many of these remain barren, and would be considered as an Ozonium; but under favourable circumstances a distinct hymenium $1\frac{1}{2}$ line thick, with a free even abrupt vertical circumference is formed in the centre of each tuft. Numbers of these at length become confluent, the strigæ towards the centre of the mass are obliterated, while those towards the circumference form an erect fringe to the patch, the edges of the hymenium coming occasionally adnate with the strigæ. If the whole be now removed from the wood, the base of each original fasciculus is often visible. Pores so minute as to be quite invisible to the naked eye, angular, sometimes a little sinuous with a rather ragged edge; dissepiments extremely thin. The colour of the whole is pale ochraceous, with more or less of a tawny tinge when dry. The specimens with which I met had been exposed to the weather for some time, and probably, when quite fresh, were nearly white. The species appears to me quite distinct, and its mode of growth very peculiar.

Tab. II. fig. 3. *a*. Various states of Polyporus cinctus, nat. size; *b*. a portion of the hymenium from the centre of one of the fascicles; *c*, a vertical section of a portion of the hymenium at the circumference of a patch; *d*. orifices of pores; *b*. *c*. *d*. more or less magnified.

7. *Thelephora puteana*, Schum. Fr. Syst. Myc. vol. i. p. 448.—On deal in a closet with a brick floor in a dairy, with a northern aspect, King's Cliffe.

I cannot refer my plant accurately to any of the varieties described by Fries in his Elenchus, the specimens themselves varying from almost perfect evenness to considerable inequality of surface, with various tints of olive, tawny, ferruginous, cinereous, &c. in the same patch. Those which grew on the under side of the shelf were the most rugged, and the patches less continuous, while others which spread from the perpendicular painted front horizontally over the brick floor, were almost even with a broad soft ochraceous margin. When placed after being gummed on paper, and preserved in the herbarium for several weeks in the original locality, where the fungus had been entirely destroyed by a solution of corrosive sublimate, and the wood work in consequence in an unusually damp season having become quite dry, which before was constantly dripping, the whole in twelve hours recovered its original fleshy appearance, and was studded with drops of coffee-coloured moisture. It should be observed that my plant when rubbed has a disagreable fishy odour.

How far it may agree with Th. fœtida, Ehr., formerly presumed by Fries a state of Th. puteana, but now rather considered as a form of Th. stabularis, I am unable to say.

8. *Th. arida*, Fr. El. i. p. 197.—In the inside of decayed hawthorn, Rockingham Forest. This species when placed in the same closet as the foregoing remained perfectly dry.

* 9. *Pyronema marianum*, Carus and Nees v. Esen. Nov. Act. Leop., &c. vol. xvii. pt. 1. p. 369, tab. 27. Thelephora carbonaria, Bertero in Hook. Herb. Eng. Fl. vol. v. p. 2, p. 169.—In the same month and year in which this curious plant, first discovered by Bertero at Juan Fernandez, occurred in England, it was met with in great abundance, by the celebrated anatomist Dr Carus at Marienbad, by whom, with the concurrence of Nees Von Esenbeck, a new genus was proposed in the last part of the above cited transactions. As this appears to be an excellent one, though very difficult of definition, I take the present opportunity of adopting it, with a slight alteration of one phrase, in the character given by Nees Von Esenbeck in an appendix to Dr Carus's paper, which appears to me calculated to mislead, and to be contrary even to Nees Von Esenbeck's own views, who appears to have worded it as it stands in deference to the description given by the learned discoverer of the plant in Germany, rather than to his own better judgment. Dr Carus, however, appears to have paid but little attention to fungi, and therefore, though any thing coming from such an observer deserves ample consideration, there is less scruple in not following him exactly. The asci which are highly developed, as in the superior Peziæ, are accompanied by paraphyses which, under a high magnifier, were found to contain globose orange-coloured granules. The true elliptic sporidia are copiously given out from the plant when laid upon a piece of glass; the contents of the more slender filaments either lose their colour completely, or are also given out, which, however, has not been observed. I suspect the former to be the real state of the case, the granules becoming invisible from transparency. That the paraphyses should contain granules is probably by no means unusual. Such would, I believe, be found the case with high magnifiers in Peziza humosa, granulata, &c. where a great part of the colour of the hymenium arises from the coloured paraphyses. The matter, however, deserves investigation, as the presumed (but not observed) evacuation of the more slender cells in the plant before us, if confirmed, would be highly curious. Till this point, however, be clearly proved, it appears to me much better to consider them as the same organs with the paraphyses in Peziza. The generic character will then stand thus:

Pyronema, Car.—Resupinate, effused; hymenium furnished with highly developed asci containing large elliptic sporidia, accompanied by paraphyses. Circumference byssoid.

That given by Nees Von Esenbeck stands thus:

Resupinate, effused. Asci of the hymenium of two kinds, each bearing sporidia; the more slender with globose coloured sporidia, the wider with larger oval hyaline erumpent sporidia. Circumference byssoid.

Besides Pyronema marianum, Thelephora sulphurea is also referred to this genus, which will come next to Thelephora.

The propriety of such reference is perhaps at present uncertain. I do not restore the original specific name of Bertero, though infinitely preferable to that given by Dr Carus, which refers to the circumstance of the plant being pointed out to him by his daughter, as it would be only adding to the number of synonyms with which mycology is already overburdened.

* 10. *Peziza rosæ*, Pers. Fr. Syst. Myc. vol. ii. p. 109.—Introduced as British on the authority of unnamed specimens in Captain Carmichael's collection. It occurred in October 1835, at Lambley Notts, and Fineshade, Northamptonshire.

11. *Pez. sanguinea*, Pers. Fr. Syst. Myc. vol. ii. p. 110.—On firwood, Beeston Notts, Nov. 1835.

12. *Pez. fusarioides*, n. s. Berk. Brit. Fung. Fasc. 2, ined.—On stems of nettles with or without Fusarium tremelloides. Apethorpe, Northamptonshire, March, April, 1836.

At first sight, this beautiful species so strongly resembles in habit Fusarium tremelloides, that it is very difficult to believe that it can be anything more than a more perfect form of the same plant, and in consequence it has probably been overlooked. Cups, scarce a line in diameter, shallow, scattered or gregarious, originating beneath the cuticle, scattered or collected in patches, at first subglobose, but slightly attached below, gradually expanding and more adnate with a rather thick, even, or flexuous border, orbicular or elongated, sometimes confluent bright orange. Asci clavate, slightly flexuous, accompanied by slender linear paraphyses, which are sometimes longer than the asci. Substance firm, not tremelloid, as in the Fusarium, which it so much resembles. Its nearest ally appears to be Peziza axillaris, Nees.

Tab. II. Fig. 4. *a*. Peziza fusarioides, nat. size; *b*. do. magnified; *c*. a young plant seen from beneath, do.; *d*. asci and paraphyses, highly magnified.

* 13. *Tremella foliacea*, Pers. Syn. p. 626.—On stumps of birch,

Wittering, Northamptonshire.—The state hitherto described as British is the purple-violet variety. Sporidia subelliptic.

14. *Sclerotium medullare*, n. s. Berk. Brit. Fung. Fasc. 2. ined.—At King's Cliffe, in the inside of stems of Pteris aquilina, which had been rotting from the previous summer, in a heap by the borders of a wood in an exposed situation. I found it only in one spot, but after a diligent search obtained a tolerable supply of specimens. At first entirely inclosed in the soft contents of the stem, subglobose, or more generally oblong, brown, then black, even, black within, with a slight shade of olive: as it swells the stem is generally split, and occasionally it protrudes and assumes a more or less sinuous form. When dry it is irregularly and coarsely corrugated, whitish within; the dark colour of the flesh is, however, restored after it has been for some time immersed in water. Outer skin, when viewed by transmitted light with a high magnifier, composed, as in Sclerotium durum, of roundish irregular cells.

Tab. III. Fig. 5. *a*. Sclerotium medullare, nat. size; *b*. do. magnified; *c*. do. do. when dry; *d*. a slice of the fresh plant; *e*. a thin slice of the outer coat; *f*. a slice of the dried plant; *d*. *e*. *f*. all highly magnified.

* 15. *Polyangium vitellinum*, Lk. Fr. Syst. Myc. vol. ii. p. 305.—On loose stumps in a wood at King's Cliffe. My specimens exactly agree with the figure of Ditmar. Occasionally the sporangia vary a little from the usual oblong ovate form, in consequence of mutual pressure towards the centre of the uterus.

* 16. *Sphæria rubiginosa*, Pers. Fr. Scler. Suec. n. 142.—This species, introduced on the authority of a single specimen from Captain Carmichael, is not uncommon, on fallen decorticated branches of service and crab in Rockingham Forest.

* 17. *S. favacea*, Fr. Scler. Suec. n. 306.—On birch, Wittering, Northamptonshire.

18. *S. detrusa*, Fr. Scler. Suec. n. 6.—On barberry, Wansford, Northamptonshire.

19. *S. velata*, Fr. Scler. Suec. n. 225.—On lime, King's Cliffe.

20. *S. microstoma*, Pers. Fr. Scler. Suec n. 185.—On blackthorn, Apethorpe, Northamptonshire.

* 21. *S. hypodermia*, Fr. Scler. Suec. n. 32.—On elm, common.

22. *S. xanthostroma*, Mont. Fr. Scler. Suec. n. 444.—On a stick used as a marker in a garden at King's Cliffe, but not completely developed.

23. *S. pantherina*, Berk. Brit. Fung. Fasc. 1.—On Pteris aquilina, King's Cliffe, &c.

24. *S. decedens*, Fr. Scler. Suec. n. 81.—On hazel, common.

25. *S. sanguinea*, var. *cicatricum*, Berk. Brit. Fung. Fasc. 2, ined.—A marked variety with very much of the habit S. coccinea, but without any stroma ; growing in patches upon the scars left by the fallen leaves of dead twigs of Buxus sempervirens, and occasionally in the axil before their leaf has fallen. It has occurred once only at Apethorpe. Perithecia much more minute than in other states of S. sanguinea, so as, except from their bright colour, to be scarce distinguishable to the naked eye, crowded, scarlet, subglobose, with a distinct very obtuse short papilla, collapsed laterally when dry. Asci linear, large for the size of the plant. There were no sporidia in my specimens gathered towards the end of winter.

Tab. III. Fig. 6. *a*. Plant nat. size ; *b*. do. magnified ; *c*. asci highly magnified.

26. *S. herpotricha*, Fr. Scler. Suec. n. 52.—King's Cliffe. On reeds and grasses.

27. *S. arundinis*, Fr. Syst. Myc. vol. ii. p. 510.—On reeds with the foregoing. Sporidia exactly resembling those of some species in the division Platystomæ.

28. *S. angelicæ*, n. s. Berk. Brit. Fung. Fasc. 2 ined.—On dead mostly decorticated stems of Angelica sylvestris, King's Cliffe, March 1836.

So minute as to be quite invisible to the naked eye, except the stem on which it grows is wet, when extremely minute black dots, the protruded tips of the ostiola, are perceived arranged in single rows upon the ribs, but not connected in any way, so that the species is better arranged amongst the Caulicolæ than Seriatæ. Perithecia black, or brownish when viewed by transmitted light, immersed in the woody part of the stem, their bases resting upon the commencement of the pith, globose, furnished with a somewhat abrupt conical subobtuse neck, which protrudes just beyond the surface of the stem, and is pierced with a minute round orifice. Contents of the perithecia pink, oozing out, and forming a little halo round the ostiolum. Asci minute, linear, containing a few subelliptic sporidia, accompanied by variously sized globules of an oily matter. The perithecia are sometimes slightly rugged, and the neck wrinkled transversely by the pressure of the woody fibres. The only species which, as far as I am aware, can at all be compared with the present is S. duplex, Sow. figured on the stem of some umbelliferous plant. Of this, as stated in the English Flora, there is no specimen preserved in his Herbarium, but if the figure and description are to be regarded, the present plant, which has not the ostiolum in the slightest degree dilated, cannot be identical with it. At all events, it is not the same species

with S. duplex, Fr. on Sparganium, &c. and is remarkable for its coloured jelly, and, if the character be constant, for the oily globules contained in it.

Tab. III. Fig. 7. *a.* Sphæria angelicæ, nat. size; *b.* two perithecia in situ magnified; *c.* contents of the perithecia highly magnified.

29. *Physarum metallicum*, n. s. On a decorticated stick at Clifton Notts, November 1835.

Peridium subglobose, slightly depressed, a line or more in breadth, sessile, (not adnate) quite smooth, very delicate, of a most beautiful metallic appearance, bursting irregularly. Sporidia and flocci pink-grey. This most beautiful plant connects Lycogala with Physarum, in consequence of its bright coloured sporidia. The peridium is, however, perfectly simple.

Tab. III. Fig. 8. *a.* Physarum metallicum, nat. size; *b.* do. magnified; *c.* flocci and sporidia highly magnified.

30. *Isaria brachiata, Schum.* Fr. Syst. Myc. vol. iii. p. 279.—On stems of hollyhock, Apethorpe, March 1836.

31. *Isaria citrina*, Pers. Fr. l. c. On the ground amongst leaves, King's Cliffe, exactly answering in every point to the plate of Ditmar.

32. *Stilbum rigidum*, Pers. Fr. Syst. Myc. vol. iii. p. 302.—On rotten wood, King's Cliffe.

33. *Stilbum piliforme*, Pers. Fr. Syst. Myc. vol. iii. p. 303.—With the former.

34. *Stilbum anomalum*, n. s. On the dead leafless shoot of some hypnum on a loose stump, King's Cliffe.

About half a line high, stem black, yellow above, generally smooth but sometimes furnished with a few short flocci towards the base, head subglobose, yellow, when placed in water falling away into subfusiform sporidia, which rest upon a flat disc-like expansion of the upper part of the stem. Exceedingly like Stilbum xanthocephalum, but agreeing with S. atractium in its subfusiform sporidia. Its consistence is not, however, at all gelatinous. Is the character of fusiform sporidia of sufficient importance to separate this species from S. xanthocephalum? I have a plant with fusiform sporidia resembling in every other respect Stilbum rigidum.

Tab. III. Fig. 9. *a.* Plant, nat. size; *b.* do magnified; *c.* do. placed in water highly magnified.

35. *Psilonia arundinis*, Desm. Fr. Syst. Myc. vol. iii. p. 451.—With Sphæria arundinis and S. herpotricha.

36. *Stilbospora angustata*, Pers. Fr. Syst. Myc. vol. iii. p. 485.—On Cornus sanguinea. Milton, Northamptonshire.

37. *Melanconium bicolor*, Nees, Fr. Syst. Myc. vol. iii. p. 488.—On birch, King's Cliffe.

V.—*Contributions to the Ichthyology of the Firth of Forth.* By R. Parnell, M. D.

I.—*The White-bait.—The Sprat.—The Herring.*

Gen. Char. Tongue and roof of the mouth with minute teeth; under jaw the longest.

Clupea alba, Yarrell. (The White-bait.) Tab. I. Fig. 1. Dorsal fin placed nearer the tip of the tail than to the point of the nose; ventral fins under the dorsal.

Clupea alosa, Donovan, Pl. 98.—White-bait, Pennant.—*Clupea alba*, Yarrell, Zool. Journal, and Brit. Fishes, ii. p. 126.

The White-bait, which is found so plentifully in the Thames, and is so well known in the neighbourhood of London, as a delicate and well-flavoured fish, was supposed by naturalists to be the young of the shad, until Mr Yarrell, in the Magazine of Natural History, proved it to be a distinct species.

In many respects it differs materially from all the other British species of Clupea, not only in specific characters, but also in its habits, and is one as distinctly marked as any of its congeners. From the beginning of April to the end of September, this fish, according to Mr Yarrell, may be caught in the Thames as high up as Woolwich or Blackwall, every flood tide, in considerable quantity; while during the first three months of this period, neither species of the genus Clupea of any age or size, except occasionally a young sprat, can be found.

About the end of March, or early in April, white-bait begin to make their appearance in the Thames, and remain till the end of September, when they are no longer to be found in the river. In the months of June, July, and August, provided the weather be fine, immense quantities are consumed by visitors to Greenwich and Blackwall, where epicures of all orders assemble for a white-bait feast.

The fishery for these fish is continued in the Thames frequently so late as September, and specimens of young fish of the year, from four to five inches long, are then not uncommon, but mixed, even at this late period of the season, with others of very small size, as if the roe had continued to be deposited throughout the summer.

The white-bait is not, as it was formerly considered to be, peculiar to the Thames, as I have found it to inhabit the Firth of Forth in considerable numbers during the summer months. From the beginning of July to the end of September they are found in great abundance in the neighbourhood of Queensferry, and opposite Hopetoun House, where I captured, on one dip of a small net,

of about a foot and a half square, between two and three hundred fish, the greater part of which were white-bait of small size, not more than two inches in length; the remainder were sprats, young herring, and fry of other fish.

In their habits they appear to be similar to the young of the herring, always keeping in shoals, and occasionally swimming near the surface of the water, when they often fall a prey to aquatic birds.

I have no doubt that the white-bait will be found to exist in the Firth of Forth throughout the whole of the year in considerable quantity, and that the fishermen would find it a new source of income, equal or superior to the spirling fishery, did they use the mode of fishing for white-bait that is practised in the Thames. But in consequence of the large extent of the estuary, and of no means being used exclusively for the capture of these fish, we can form but a faint idea of the number that may there exist.

The white-bait net which is used in the Thames is not large; the mouth of it measures only about three feet across, but the mesh of the hose, or bag-end of the net, is very small. A boat is moored in the tide-way, where the water is from twenty to thirty feet deep; and the net with its wooden frame is fixed to the side of the boat. The tail of the hose, swimming loose, is from time to time brought into the boat, the end untied, and its contents shaken out. The wooden frame forming the mouth of the net does not dip more than four feet below the surface of the water.

The largest specimen of Clupea alba that I have met with, taken from the Firth of Forth, measures five inches in length. The upper part of the back, from the nape to the tail, is of a pale greenish ash-colour, the sides, gill covers, pectoral, ventral, and anal fins, of a beautiful pure white; the dorsal and caudal fins straw colour, minutely spotted with dark brown. The head on the summit in young specimens is marked with a large brown spot, which is divided anteriorly by a white line. Each orbit on the superior margin is tinged with black, as well as the posterior inferior margin, but in a less degree. The shape of the body resembles that of the young herring, but it is more compressed and of a deeper form.

The first ray of the dorsal fin commences exactly midway between the point of the upper jaw and the end of the middle caudal ray; the ventral fins are placed behind the third ray of the dorsal; the tail is deeply forked, the middle ray being not quite half the length of the longest ray of the same fin. The fin rays in number are,

D. 17; P. 15; V. 9; A 15; C. 20; Vert. 56; Cœcal append. about 15.

The head, in a specimen five inches long, is not quite one-fourth

the length of the whole fish. In a fish four inches long, the head is exactly one-fourth the entire length. In one two inches long, the head measures more than one-fourth the whole length. Each jaw on the anterior part is furnished with a few small slender teeth, about six in number, placed in one row, which are more perceptible on the lower than on the upper jaw; on the roof of the mouth as well as on the tongue, are placed three or more rows of teeth, which can be easily felt by the assistance of the point of a fine needle. In this respect my observations differ from those of Mr Yarrell, who says, the tongue of the white-bait has an elevated central ridge without teeth; but it is probable that that author did not examine a dried specimen, for until in that state, it is almost impossible to perceive the teeth, in consequence of their extreme minuteness. This is a most important character, and at once removes it from the shad, which has the tongue and roof of the mouth destitute of teeth.

The white-bait, four inches long, differs from the herring, sprat, and pilchard of the same length, in the following characters:

The herring has the dorsal fin half-way between the point of the upper jaw and end of the long caudal rays; with the head nearly one-fifth the entire length. The white-bait has the dorsal fin much nearer the tip of the tail, than to the point of the upper jaw, with the head one-fourth the length of the whole fish; the body is more compressed, of a much lighter colour, and the belly much rougher under the pectorals, than is observed in the herring.

The sprat has the origin of the ventral fins situated anterior to a vertical line dropped from the first dorsal ray, with 48 vertebræ; the white-bait has 56 vertebræ, with the origin of the ventral fins placed behind the third ray of the dorsal. In the pilchard the dorsal fin is placed exactly in the centre of gravity, so that when the fish is held up by the anterior rays, the body preserves an equilibrium, whereas if the white-bait, herring, or sprat, be taken up by the same part, the head will be observed to dip considerably.

The stomach of the white-bait I have found frequently filled with minute crustacea.

Clupea sprattus.—(Sprat or Garvie Herring.) Tab. I. Fig. 2. Dorsal fin nearer the tip of the tail than to the point of the upper jaw; ventral fins before the dorsal.

This little fish, although well known to every one by the name of Sprat or Garvie Herring, is not admitted by all to be a distinct species, being considered as the young of the pilchard or the herring. This mistake is not to be wondered at, since authors either omit the

most important characters, or place reliance on characters which do not exist.

Sprats are found in the Firth of Forth throughout the whole of the year, and, like many small animals, appear to be very susceptible of cold. During the warm summer months, they are seen sporting about in large shoals, in every part of the Firth, occupying a considerable extent of water, and causing a ripple on the surface with their fins, while they become the principal food of many marine birds, which assail them in the water, or prey on them from above. As the cold weather advances, these little fish are no longer seen in the lower part of the estuary, but are found to ascend the Firth to a considerable distance, and to select that part of the river where the fresh and salt waters mingle together; for it is a well known law in chemistry, that when two fluids of different densities come in contact, the temperature of the mixture is elevated for a time in proportion to the difference in density of the two fluids. Owing to mutual penetration and condensation, such a mixture is constantly taking place in the rivers that run into the sea, and the temperature of the mixed water is accordingly elevated. In the year 1830, the sprat was remarkably abundant all over the British coast, but more particularly on the coasts of Kent and Essex, where they were taken in immense quantity, so that they were sold at sixpence a bushel as manure for the land.

The sprat is generally considered as a delicious well-flavoured and wholesome fish, and is eaten in considerable quantity in this country, both in the fresh and salted conditions, but is very seldom brought to the Edinburgh market. They spawn early in the month of March, and feed on small crustaceous animals.

The most common size of a sprat is from four to five inches in length, but it is observed occasionally to exceed six inches and a half, when it is named in the neighbourhood of Alloa the King of Garvies.

The colour of the back is a deep glossy blue, the sides, belly, and gill-covers of a pure silvery white, passing into green and blue reflections, when viewed in different lights; the dorsal and caudal fins dusky, minutely spotted with black; the pectoral and ventral fins white, slightly tinged with orange. On the crown of the head is a dark spot placed between the eyes, which is very perceptibly seen when young, but as the fish increases in size the spot gradually becomes obliterated. The eye is large, the diameter being not less than one-fourth of the whole head; the upper and lower margins are tinged with black. Each operculum has a slight notch placed on its upper and posterior edge. The teeth in the jaws are small,

slender, and few in number; they are situated on the most anterior parts, and are more obvious on the lower than on the upper jaw; the tongue as well as the roof of the mouth is also armed with fine teeth, their points being slightly bent inwards. The under jaw is the longest. The belly is strongly serrated as far as the anal aperture. The convexity of the dorsal and abdominal lines is much greater than is observed either in the white-bait or the herring. The fin rays in number are.

D. 17; C. 19; P. 15; V. 7; A. 18; Vert. 48; Cœcal append. about 12.

The dorsal fin commences exactly half way between the point of the lower jaw and the end of the middle caudal rays. *

The ventral fins arise anterior to a vertical line dropped from the origin of the first dorsal ray, and have distinct axillary scales, nearly half as long as the fin, which are always present in a recent and perfect sprat. †

The scales are large, about the size of the orbit, round, and very deciduous. They are placed in seven rows between the dorsal and ventral fins.

The sprat differs from the herring, white-bait, pilchard, and shad in two most striking characters; in having only 48 vertebræ, and in having the origin of the ventral fins placed before a vertical line dropped from the commencement of the first dorsal ray.

Clupea harengus.—(The Herring.) Tab. I. Fig. 3. Dorsal fin half way between the point of the upper jaw and end of the long caudal rays.

Herrings enter the Firth of Forth about the end of December, or the beginning of January, and remain two or three weeks at the mouth of the estuary before they attempt to ascend. This delay seems greatly to depend on the state of the weather, for in some seasons when it is mild and fine, the herring has been observed to swarm in the Firth off Musselburgh in the early part of January; whilst in the rough and stormy seasons they do not make their appearance in that part of the river before the middle of February, and always disappear before the end of March. They seem to visit the Firth regularly every winter, and a season very seldom passes without a few being captured and sent to the Edinburgh market. Some years they appear in much larger shoals than in others, the reason of which is not accounted for. In the year 1816, pilchards

* In Yarrell's British Ichthyology, vol. ii. p. 124, the dorsal fin is said to commence exactly half way between the point of the lower jaw and end of the caudal rays.

† In Yarrell's British Ichthyology, vol. ii. p. 124, it is there stated that the ventral fins arise in a vertical line under the first dorsal ray, and have no axillary scales.

were taken in the Firth of Forth in great abundance, when not a dozen herrings were seen during the whole winter. Since that time not a single pilchard has been known to enter the estuary.

" The herring is in truth a most capricious fish," says Dr Macculloch, " seldom remaining long in one place ; and there is scarcely a fishing station round the British islands that has not experienced in the visits of this fish the greatest variations both as to time and quantity, without any accountable reason. In Long Island, one of the Hebrides, it was asserted that the fish had been driven away by the manufactory of kelp ; some imaginary coincidence having been found between their disappearance and the establishment of that business. But the kelp fires did not drive them away from other shores, which they frequent and abandon indifferently without regard to this work. It has been a still more favourite and popular fancy, that they were driven away by firing of guns ; and hence this is not allowed during the fishing season. A gun has scarcely been fired in the Western Islands, or on the west coast, since the days of Cromwell : yet they have changed their places many times in that interval. In a similar manner, and with equal truth, it was said that they had been driven from the Baltic by the battle of Copenhagen. It is amusing to see how old theories are revived. This is a very ancient Highland hypothesis, with the necessary modifications. Before the days of guns and gunpowder, the Highlanders held that they quitted coasts where blood had been shed : and thus ancient philosophy is renovated. Steam-boats are now supposed to be the culprits, since a reason must be found. To prove their effect, Loch Fyne, visited by a steam-boat daily, is now their favourite haunt, and they have deserted other lochs where steam-boats have never yet smoked. A member of the House of Commons, in a debate on a tithe bill lately stated, that a clergyman having obtained a living on the coast of Ireland, signified his intention of taking the tithe of fish, which was, however, considered to be so utterly repugnant to the privileges and feelings of the finny race, that not a single herring has ever since visited that part of the shore."

In June, July, and August, herrings are taken off the Dunbar and Berwick coasts in considerable number, from whence the Edinburgh market is abundantly supplied, when scarcely a single herring is to be seen higher in the Firth of a size worth the notice of the fishermen.

Herrings are said to deposit their spawn towards the end of October, and it is nearly three months previous to this operation that they are found to appear on our shores, when they become of so great a national importance.

The spawning of these fish in October only, does not appear to

me to account for the number of small fry, two inches in length, that are found in the Firth of Forth during the month of July ; and the young herrings that are taken from six to seven inches long in the month of February, mixed with fry from two to three inches in length. When herrings are brought to the market in the first two months of the year, I have always found them full of spawn, and in the middle of March I have observed many very lank, with not a single ovum to be seen. Hence it is not improbable, that the same species of herring might spawn twice in the year, early in the month of March and also towards the end of October.

Pennant supposes that the herring migrates to a considerable distance ; that they begin to appear first off the Shetland Islands in April and May, and divide into distinct columns from four to six miles in length and three to four in breadth ; and that after they have taken their circuit, they return again to the Arctic circle, where they recruit themselves after the fatigue of spawning. But it is more consistent to suppose, that the herrings approach our shores for the purpose of depositing their spawn like other fishes, and when this is accomplished, return again to the deep sea.

The most common length of a full-grown herring is eleven inches, and two and a quarter deep. The upper part of the back is of a deep glossy blue ; the sides and belly silvery white. Each jaw on the anterior part is furnished with six or eight teeth placed in one row, which are more perceptible on the lower than on the upper jaw ; the vomer is supplied with a double row, about sixteen in number ; on each side is another row of teeth, which are rather smaller ; the tongue is also armed with teeth, arranged in three or four rows, with their points directed inwards ; the under jaw is longest, and is tipped with black ; eyes large and silvery, placed nearer to the point of the nose than to the posterior margin of the operculum. The first ray of the dorsal fin in an adult fish arises exactly half way between the point of the upper jaw and the base of the middle caudal rays ; the origin of the ventral fins is placed behind the third dorsal ray, half way between the point of the lower jaw, and a little beyond the end of the middle caudal rays.

The fin rays in number are :

D. 17 ; C. 20 ; P. 16 ; V. 9 ; A. 15 ; Vert. 56 ; Cœcal append. 21.

The tail is deeply forked, the middle rays less than half the length of the longest ray of the same fin ; the second ray of the dorsal fin, a little longer than the base of that fin ; the scales are large, oval, and very deciduous, placed in fifteen rows between the dorsal and ventral fins. Most authors suppose that the belly of the herring is not serrated in any stage of its growth, which is said to form

a good specific distinction between it and the sprat; but it will be found that this is not the case, for a herring less than six inches in length is as distinctly serrated on the belly with thirty-six teeth,* between the ventral and anal fins, as a sprat of equal size; but as the herring increases in size, so the serratures become obliterated, and, by the time the fish reaches to the length of eight inches, the belly will be found to be no longer serrated, but carinated.

The most prominent specific distinction of the herring, from the sprat, white-bait, and pilchard, is in the position of the dorsal fin, which is placed exactly in the middle of the fish, half way between the point of the upper jaw, and the end of the longest caudal ray.

Dr Knox considers the food of the herring, while inhabiting the depths of the ocean, to consist principally of minute entomostracous animals; but it is certainly less choice (adds Mr Yarrell) in its selection when near the shore. Dr Neill found five young herrings in the stomach of a large female herring; he has also known them to be taken by the fishermen on their lines, the hooks of which were baited with limpets. I have often found the young of the white-bait and small shrimps in the stomach of herrings when they were not in roe; but when they are about to spawn their stomachs (as is observed in most other fishes at that period,) appear as if empty and destitute of any perceptible food. On the authority of Dr Fleming the fry have even been caught with a trout-fly.†

April 18, 1836.

VI.—*The Honey-Bee community. Length of life allotted to its different members.* By Edward Bevan, M. D.

This is a subject upon which, I believe, no precise information has ever been presented to the public. "Cool courage and steady perseverance, crowned with unincumbered leisure," says Dr Evans, "can alone expect to unlock this curious arcanum in Natural History."

The opinions of the ancients respecting it were extremely vague and indefinite. The length of life allotted by *them* to the *working*

* The serratures can be more evidently perceived when the abdominal scales are removed (as in Fig. 3.) which often project beyond the teeth, and prevent their points from being felt, when the finger is passed from the anal fin towards the pectorals.

† On the coasts of the West Highlands, herrings for many years past have been taken with the rod, the hook dressed with a white feather (generally from some of the gulls.) Near Oban, and upon the shores of Mull and Jura, twelve dozens are sometimes taken by a single boat during the evening.—Ed.

bees was from *seven* to *ten* years: in later times, writers on bees have regarded it as not much exceeding *a year;* but the notions of both ancients and moderns, upon this subject, have been purely conjectural. Indeed it appears to be somewhat doubtful, whether the length of life which the former seem to have attributed to individual bees, was not meant to apply to the existence of each bee-community; though the language they make use of fully justifies the former construction, excepting in the case of Columella, who clearly regarded the ten years as applicable to the latter. "Durantque, si diligenter excultæ sint, in annos decem, nec ullum examen hanc ætatem potest excedere, quamvis in demortuarum locum quotannis pullos substituent. Nam ferè decimo ab internitione anno, gens universa totius alvei consumitur."

An intelligent critical writer in the Westminster Review, when remarking upon my own reference to the length of the bee's life, in my Treatise on that insect, expressed his regret that we possessed no positive evidence which could throw light upon it. This gentleman's observations induced me to direct my attention more closely to the subject, first theoretically, then practically; and I shall now proceed to give the result of my inductive reasoning, as well as of my actual observation.

A good family of bees being known to consist of from 12,000, to 20,000, and a fertile queen to breed that number, at least, every year, which, under favourable circumstances, is usually thrown off by swarming, it appeared to follow, as a matter of course, that if swarming were prevented by affording hive-room to the bees, the number during the breeding season would often be more than doubled, and that, if their lives were extended even to the shortest period hitherto assigned them, they would remain in a crowded state till the following spring. But repeated experience has clearly shown that the population of families, which have been thus accommodated with room, if examined in the following winter, do not consist of more than 2000 or 3000. After receiving a great increase in the ensuing spring, they again suffer a similar reduction before the succeeding winter; and this regular alternation of increase and decrease will go on for years, keeping a family that has been duly supplied with hive-room, at about the same average amount at each respective period of the year. This reduction to the smaller number above stated, every successive winter, can only be produced by the old bees dying, and leaving the business of the family to be conducted by young ones; and it affords, I think, conclusive evidence, that the *working-bee's* life is regularly cut off in *less than a year.*

The period at which the queen bee deposits her greatest number of eggs is the spring, and it has been emphatically called *the great laying*. I think the facts above stated amply justify the opinion, that all the bees brought into existence by this laying, die before winter, and are succeeded by those hatched at intervals during summer and autumn, and in mild weather, during part of the winter also. The proportion of eggs deposited by the queen at these latter layings, when compared with the great laying in spring, accounts satisfactorily, upon the theory above stated, for the great disparity in the populousness of a storified or collateral family of bees, at different periods of the year. This view of the matter renders it more than probable, therefore, that *the life of the working bee does not exceed six or seven months.*

In order to illustrate my theory I will give below a summary, which, though not pretending to minute precision, may possess sufficient for the purpose.

Bees constituting a family in February, - - -	3000
Spring bred bees, - - - - -	17000
Summer and autumn do, - - - - -	6000
	26000
Removed by death between February and December, -	23000
Thus bringing the family down to the February number,	3000

Thus far I was conducted by theory: a theory which I propounded to my apiarian friends several years ago, and which they all regarded as being invulnerable: I have recently had an opportunity of confirming its *general* correctness by the result of an experiment, the particulars of which I will now detail.

On the 13th of June 1835, I introduced a prime swarm to my mirror-hive, the early proceedings of which bore so close a resemblance to those which occurred to Mr Dunbar, as reported in the Edinburgh Philosophical Magazine, that I need not detail them here. On the first of July, when the queen was in the midst of her laying of drone-eggs, and when the hive was well stored with honey, eggs and brood in all stages, I removed her majesty from the family. Though I watched assiduously from early morn till late at night, for several days, no agitation was perceptible. Still I concluded that the bees were aware of the loss they had sustained, as on the second day I perceived the foundation of four royal cells, which were closely attended to by the workers. The general business of the family went on with as much alacrity as usual, pollen was duly carried in, honey-cells were stored and sealed over, brood cells cleared

out and replenished with honey, and, in short, not the slightest evidence was afforded of the absence of the queen. The usual period for enlarging and sealing up the royal cells passed away, but they never proceeded beyond the state of acorn cups. There was, however, no remission in the attention paid to them by the workers. In a few days the young workers began to issue from their cells, and on the 13th of July, I perceived the first issue of drones. From this period both were to be seen emerging daily; the latter continued to come forth till the 25th. This state of affairs somewhat perplexed me, and, as was natural, gave birth to theorizing. Some might have said it was a case of instinct at fault: to me it appeared to be an instance of one instinct overpowering another. I have stated, that on the second day of the queen's removal, I perceived the rudiments of royal cells; I question much whether if, at that time, I had more narrowly inspected the combs, I might not have seen the acorn-cups when I removed her: if so, I should regard this as the cause of failure, for in case of their being found during her majesty's occupancy of the hive, the bees would naturally expect *her* to make the usual deposits in them, and the constant attention which they paid to these cells, by incessantly popping in their heads, gives countenance to the opinion. That such was the expectation of the bees, receives still farther countenance from the situation of these royal cradles; they were constructed upon the edges of the combs, as I believe the *natural* cradles of royalty always are; not formed by the breaking down of *worker-cells*, as is the case when *artificial* cradles are constructed. Admitting this to be a sound view of the matter, it would seem not improbable, considering the populousness of the stock, and the warmth of the weather, that, had I removed the queen a day or two earlier or a day later, one or more royal cradles would have been perfected; as in the first case there would most likely have been a formation of *artificial* ones, and a consequent raising of *artificial* queens; in the latter case there *might* have been a tenanting of the *natural* cells of royalty, and a maturation of *natural* queens. In both these respects I was disappointed; no queen was raised, and yet, though no substitute for the old one was presented to the family, there was no abatement of their watchfulness, nor any relaxation of their diligence.

The circumstances under which this family of bees was placed, appeared to offer a favourable opportunity for ascertaining the age to which the life of the working-bee as well as that of the drone might extend. I knew that all the young workers were hatched within three weeks after the removal of the queen, and all the drones

within twenty-four days of that time. I carefully watched the proceedings of the family during the remainder of the year, but till the close of autumn nothing different was noticeable in their proceedings from what would have taken place, if the queen had been with them, excepting that there was no massacre of the drones, nor any deposition of fresh ova; both the store and the brood-cells were richly furnished with honey. The hive was situated in an upper apartment of my dwelling-house, well protected from cold,—the quicksilver in Fahrenheit's thermometer, which hung near them, seldom ranging below 45° and never lower than 43°. The drones began to decline in number towards the end of October, and by the middle of November not a single drone remained. Soon after their extinction there was a gradual but manifest diminution of the working-bees. They continued decreasing till the 30th of December, when only thirteen remained alive: these were quite active on the morning of that day, but before night two of them had expired; the other three, when I retired to rest about eleven o'clock, were moving briskly about upon the comb, but when I rose next morning (31st) they also had closed their career. Apprehending when the family became very much reduced, that so small a number of bees would be unable to maintain a due degree of heat, I not only surrounded the hive with a thick coating of wool, but kept a fire in the apartment night and day, which preserved a regular temperature of between 50° and 60° Fahrenheit.

From this detail it will, I think, appear pretty evident, that the average life of the drone is about four months, whilst that of the working-bee is extended to about six months. It will also appear that their lives are cut off rather suddenly,

> "The race and realm, from age to age remain,
> Time still renewing with new links the chain."

On the extinction of the family I took from the hive nearly twelve pounds of fine liquid honey.

The result of this experiment, as respects the length of the working bee's life, fully confirms, so far as a single experiment can do, the opinion which I had previously formed, and it receives additional strength from another that was instituted by Reaumur. He marked 500 bees in April with red varnish, and saw them alive a month afterwards; but in the succeeding November not one of them could be distinguished. This circumstance, standing alone, cannot be regarded as conclusive; for, in the first place, the red varnish might have peeled off, prior to his last observation, and, in the next place, it is

possible that none of the marked bees might have been spring bred; but, taken in conjunction with the facts detailed as having been noticed by myself, illustrating as they do the theory which precedes them, I think it may be received as strongly confirmatory of the opinion that the working bee's life is much shorter than has usually been supposed, as it seems highly probable that at least *some* of the bees marked by Reaumur, if not all, were the produce of the spring laying, and whether or not the varnish and the bees had disappeared together, no doubt he observed in November a very manifest diminution in the populousness of the family.

It now only remains that I should advert to the longevity of the queen-bee, and upon this point the evidence which we possess is sufficiently ample to justify a decisive statement. The experiments of Huber, Della Rocca, Dunbar, and Golding, have clearly proved that *her* majesty sees many generations pass away before she quits the stage herself. Huber, though he only speaks positively of her life's being extended to two years, was of opinion, I believe, that it might reach to four or five; and the three latter naturalists, by marking their queens, have traced them from hive to hive, through a period of *nearly four* years; a coincidence, in point of time, which, while it justifies the opinion of Huber, speaks strongly in favour of the diligent and accurate observation of Della Rocca, Dunbar, and Golding. Della Rocca's queen had accidentally lost a leg in being hived, the others were distinguishable by having had one of their antennæ clipped, neither of which bereavements prevented the fulfilment of every royal function.

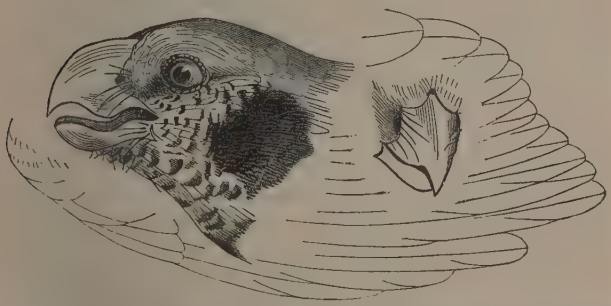
VII.—*On the Genus Paradoxornis.* By J. Gould, F. L. S., &c.

Central Asia, with its varied regions, constitutes a country, perhaps second to none for the novelties it continues to unfold to the contemplations of the inquiring naturalist; the great elevation of its mountains afford a temperature reduced to that of the arctic regions, while from its comparative southern latitude, its plains possess all the features of the torrid zone. Between these extremes it may be said to represent every variety of temperature. In the rich valleys of various altitudes, coated with the finest alluvial soil, and constantly irrigated by streams from the surrounding hills, such a mass of luxuriant vegetation is produced as can be only imagined by those who have visited this highly favoured country.

The most important inference that has been drawn from our knowledge of this fine portion of the world, is, that temperature rather

than latitude chiefly influences the natural productions of any given climate ; and this fact has been so completely verified by the observations of various scientific travellers, that I need not here insist upon it. With the knowledge of such a fact, the discovery of birds within the temperate and colder regions of the Himalaya resembling in form those of very different latitudes, but of similar temperature, will not excite much surprise. Indeed it is in regions so vast and little explored as the country of the Himalaya, Nepal, &c., that we may expect to meet with new modifications of forms, which lead us to wonder at the exhaustless variety of nature. The curious bird whose characters are now given, is one of the most singular and novel form which has come under my notice for some years. I have to regret that no information with regard to its habits and natural economy have reached me. I have only as yet obtained a single specimen, and its affinities are so obscure, that I have not been able, with any degree of confidence, to assign its place in the natural system. I must, therefore, content myself with describing its character, and leaving it to the scientific readers of "The Magazine of Zoology and Botany," to draw their own inferences.

Genus Paradoxornis, Gould.



Gen. Char.—Bill of greater depth than length, the upper mandible strongly compressed, with a sharp and boldly arched culmen, bending to a point, and without a notch, the cutting edge of the upper mandible deeply incurved towards the tip, and produced at the base ; *nostrils small and round, situated outside the horn of the mandible ;* under mandible broad at its base, stout, and indented so as to fit the edges of the upper mandible ; just before and beneath the eye, spring several strong bristles ; the same occur, but are more feeble, at the base of the lower mandible ; wings short and rounded,

fourth, fifth, and sixth feathers nearly equal, and longest; tail moderately long and graduated; feet large, under parts broad and adapted for grasping; toes large, hind toe greatly produced; plumage full and loose.

Paradoxornis flavirostris.

Specific Char.—Bill rich orange-yellow; crown of the head and back of the neck rich rufous brown; the whole of the upper surface, wings and tail, sandy-brown; face and throat white, mottled with black; part of the ear-coverts jet black; upper part of the chest grayish-white clouded with black; under surface pale sandy-brown; tarsi and feet bluish.

Total length, 8 inches; wings, $3\frac{1}{2}$; tail, $14\frac{1}{2}$; tarsi, $1\frac{1}{4}$; hind toe, $\frac{7}{8}$. Habitat, Nepal. In the collection of Mr Gould.

VIII.—*The Natural History of British Zoophytes.* By George Johnston, M. D., Fellow of the Royal College of Surgeons of Edinburgh.

I.—History of Zoophytology.

The natural productions about to occupy our attention, have been denominated Zoophytes because, according to some, they partake of the nature both of vegetables and animals, and connect the two kingdoms of organized matter; or because, as others define the term, having the outward semblance of sea-plants, they are yet in reality the formations of little animals or polypes that nestle in the cells or tubes of the zoophyte, to which they are organically and indissolubly connected.

Little more than a century has elapsed since the first discoveries were made on which these opinions are founded. Previously to that time zoophytes were considered the undoubted subjects of the vegetable kingdom, naturalists being obviously led to this allocation of them by their arborescent appearances, in which it were vain to trace any likeness to any common animal forms; and by their permanent fixedness to the objects from which they grow, for zoophytes are attached by means of a disk or tubular fibres much in the same way that marine plants are, while the capability of moving at will from place to place was deemed to be the principal character of distinction between the two classes of animated beings. The zoologist claimed none of them, if we except the Actiniæ or animal-flowers, for his province and study, but left them without dispute to botanical writers; and if any of these, in reference to a very few zoophytes of the least arborescent character, hazarded a whispered conjecture

that they were wrongly classed, it died away in the utterance, and raised no echo to further inquiry. The only opposition to the botanical theory came from the mineralogists, who some of them questioned the vegetability of such of these productions as were of a hard and stony nature, contending they were rather rocks or stones formed by the sediment and agglutination of a submarine general compost of calcareous and argillaceous materials, moulded into the figures of trees and mosses by the motion of the waves, by crystallization, by the incrustation of real fuci, or by some imagined vegetative power in brute matter. But although not more—perhaps less repugnant to the outward sense than the opposite hypothesis, yet the mineral theory seems at no time to have obtained very general favour or credit; and accordingly we find that, in the works of Tournefort and Ray, the leading naturalists of the age immediately antecedent to the discoveries which led to the modern doctrines, the zoophytes, whether calcareous and hard, or horny and flexible, were arranged and described among sea-weeds and mosses without any misgivings concerning the propriety of doing so.

Ferrante Imperato, an apothecary in Naples, was the first naturalist, according to M. De Blainville, distinctly to publish, as the result of his proper observations, the animality of corals and madrepores; and he is said to have accompanied the descriptions of the species which fell under his notice with illustrative figures of considerable accuracy. His work, of which De Blainville speaks highly as one of the most important in the history of zoophytology,* was printed at Naples in 1599; but although reprinted some years afterwards (1672), it, and the knowledge it contained, sunk into such complete oblivion, that when Peyssonnel, in the year 1727, communicated the same discovery to the Academy of Sciences in Paris, it was received by the members of that learned body in a manner which is sufficient to convince us that it was entirely new to them, and exposed the author to the obloquy and censure which are the usual portions of an original discoverer.

Some time previously to the publication of Peyssonnel's discovery, those who maintained that the stony zoophytes were plants had re-

* Lamouroux on the contrary places Imperato on the same level with Gesner, Boccone, and Shaw—none of whom had any distinct notion of the animality of *any* zoophytes, and had no doubt of the vegetable nature of almost all of them. "Les observations de ces hommes célèbres, au lieu d'éclairer les naturalistes sur cette branche intéressante de la science, embrouillaient encore plus son étude."—Lam. Cor. Flex. Introd. p. xiv. The opinions of Rumphius seem to have been as explicitly stated as those of Imperato, but they effected nothing.—Pall. Elench. 14, and 275.

ceived a strong corroboration of their opinion from the researches of Count Marsigli, who, having detected the existence of polypes in coral and madrepore, had, under the influence of the fashionable theory, described them as being literally their blossoms or flowers.* Peyssonnel, therefore, had to contend not only against the prejudices of the vulgar based on appearances which spoke direct to the outward sense, but against the actual observations of a naturalist of acknowledged merit; and the observations of Peyssonnel, although numerous and unequivocal, were yet mixed up with so much that was fanciful or erroneous, that it is not wonderful his opinion was received with coldness and suspicion. Reaumur, to whom Peyssonnel's communication was intrusted, even concealed the name of the author when he laid it before the Academy, with the benevolent intention doubtless of shielding him from the scorn and ridicule that might possibly be the lot of one who had ventured to contradict the observations of an Italian Count, and to oppose the established belief;† and he immediately afterwards read, before the same academicians, an essay of his own, in which he opposed the theory of Peyssonnel with numerous objections, and attempted to explain the growth of coral in accordance to the admitted principles of vegetable physiology.‡

The memoir in which Peyssonnel originally proposed his doctrine does not appear to have been published: the only account I have seen of it is contained in the essay of Reaumur just alluded to. He maintained that what Marsigli had described as the blossoms of coral, were true animals or insects analogous to the Actiniæ or sea-anemones; that the coral was secreted in a fluid form by the inhabitant Actiniæ, and became afterwards fixed, hard, and changed into stone; and that all other stony sea-plants, and even sponges, are

* "Ce fut une découverte qui fit grand bruit dans le monde naturaliste, que celle des fleurs du corail." Reaumur.—Marsigli's work was published in 1711. His name is sometimes written *Marsilli*.—For an account of his works see Haller, Bib. Bot. i. 630.

† "L'estime que j'ai pour M. Peyssonnel me fit même éviter de la nommer pour l'auteur d'un sentiment qui ne pouvoit manquer de paroître trop hasardé."—Reaumur.

‡ Observations sur la formation du corail, et des autres productions appellées Plantes pierreuses. Par M. de Reaumur.—"Il prend pour une Plante l'ecorce grossiere et sensible du corail, tres-distincte de ce que nous appellons corail, et de plus une autre ecorce beaucoup plus fine, et que les yeux ne distinguent point de la vraye substance coralline qu'elle revêt; et tout le reste du corail, presque toute la substance coralline n'est qu'une pierre sans organisation."—Hist. de l'Acad. Roy. des Sc. 1727. p. 51. and more particularly his own memoir in the same vol. p. 380

the work of different insects, particular to each species of these marine bodies, which labour uniformly according to their nature, and as the Supreme Being has ordered and determined. Reaumur remarks, that these opinions were not entirely the offspring of fancy: it would have been more candid and just had he said they were simply the convictions of a practical naturalist, who had long and patiently studied the productions in question, in their native sites on the coasts of France and of Barbary. Peyssonnel had seen the polypes of coral and of the madrepores; he recognized their resemblance to the naked animal flowers; he had witnessed their motions,—the extension of their tentacula, and the contraction and opening of the oral aperture; he ascertained that, unlike flowers, they were to be found the same at all seasons; that their corruption exhaled the odour; their chemical analysis discovered the constituent principles of animal matters; and that the stony part of them exhibited no trace of vegetable organization: and opinions deduced from such data, abstracting his analogical reasoning of no value and little applicability, might have been sufficient to have attracted at least some attention had his opponent been less influential, or his own reputation and rank somewhat greater. *

The name and doctrine of Peyssonnel lay in this manner unknown and neglected, until the remarkable experiments of Ab. Trembley, in 1741, on the reproductive powers of the fresh-water polypes,† and more especially his discovery of the Plumatella, itself a plant-like animal production, while they extorted the wonder and admiration of every one engaged in the study of natural science, were the means of recalling to the recollection of Reaumur the views of Peyssonnel; and he now became forward in promoting such inquiries as seemed likely to confirm and extend them. He himself ap-

* Peyssonnel is known solely by this discovery. "M. Peyssonnel, disposed from his youth to the study of natural history, after having qualified himself for the practice of medicine, applied himself with great diligence to that science, to which his inclinations so strongly prompted him, and being a native of, and residing at Marseilles, he had the opportunity of examining the curiosities of the sea, which the fishermen, more especially those who search for coral, furnished him with."—Phil. Trans. He was subsequently appointed Physician-Botanist to "His Most Christian Majesty" in the island of Guadalupe, and had an opportunity of prosecuting his researches on the coasts of Barbary. He is the author of two or three communications in the Phil. Trans., of which the most interesting is "An account of a visitation of the Leprous persons in the isle of Guadalupe" in the volume for the year 1757.

† In the Phil. Trans. for 1742, the reader will find a full account of this discovery.

pears to have repeated the experiments of Trembley, and had an opportunity of observing the habits of the Plumatella ; and, as he remarks, since the number of species of animals which are covered by the waters of the sea is much greater than that of the fresh waters, so it seemed natural to presume that not only would polypes be found in the ocean, but in greater numbers and variety than in ponds, rivers or rivulets. To ascertain the validity of this conjecture, and to settle if possible the discrepancy between the observations of Marsigli and Peyssonnel, his friends Bernard de Jussieu and Guettard * proceeded, in the autumns of 1741 and 1742, to different parts of the coasts of France with the view of examining their zoophytical productions ; and both were soon satisfied of the truth of the animal theory. Bernard de Jussieu in particular shewed that it was equally applicable to many zoophytes which Peyssonnel had not examined, and whose animality had not yet been suspected, viz. the flexible and delicate Sertulariæ, the Flustra, and the Alcyonium or Lobularia, the latter of which seems to have excited much astonishment by the protrusion of its thousands of polypes of a size large enough to be seen and examined at ease with the naked eye.†

The memoir which Jussieu presented to the Academy of Sciences in Paris is short, but characterized by great distinctness and precision in the detail of his observations, and illustrated with excellent figures ;—his aim being evidently not to entrap our blind assent by a declamatory display of the new wonders opened up in science, but to prove his conclusion to be the true one in the eye of reason and sobriety. He limits his descriptions and remarks to four species, viz. Lobularia digitata, Tubularia indivisa, Flustra foliacea, and Cellepora pumicosa, which seem to have been selected as examples of the more remarkable tribes, for it is evident he had examined many more, but his observations on them were reserved for another memoir which, I believe, was never written.‡—Reaumur's advocacy of

* Lamouroux speaks highly of the labours of this naturalist, whose attention seems to have been chiefly directed to fossil polypidoms and to sponges.—Corall. Flex. Introd. p. xvii. See also Hall. Bib. Bot. ii. 341.

† Examen de quelques productions marines qui ont ete mises au nombre des Plantes, et qui sont l'ouvrage d'une sorte d'Insectes de mer. Par. M. Bernard de Jussieu. 14th Nov. 1742. Published in 1745.—See Hall. Bib. Bot. ii. 281.

‡ That Jussieu had ascertained the animality of the Sertulariadæ is, I think, indisputable from the following passage. " Il s'en presentoit ensuite quantite de celles qu'on appelle Corallines, les unes pierreuses dans lesquelles je ne remarquai rien, et les autres dont les tiges et les branches, et ce qui passoit pour feuilles, etoient d'une apparence membraneuse, dans lesquelles je decouvris que ce qu'on y prenoit pour feuilles disposées alternativement, ou dans un sens

the new doctrine was in a more popular style, but not the less excellent: he gave a short exposition of the ascertained facts,—reviewed with the clearness of an eye-witness the discoveries of Trembley,—pointed out their relations to the experiments of Jussieu and Guettard, and how they mutually lent and borrowed strength,—palliated and explained away his former opposition to Peyssonnel,—and declared his complete faith in the animality of Zoophytes, and his conviction that a numerous list of productions hitherto unexamined would be found to be of the same nature. "All that we have said," he thus concludes, "of the polypes of the sea, is merely a sort of advertisement which, however, cannot fail to produce the effect which we promise ourselves from it: it will direct undoubtedly the curiosity of naturalists who reside by the sea to insects so worthy of being better known. They will seek out the different species; they will delight to describe to us the varieties presented in their forms never but remarkable; they will study the figure and disposition of the cells of the various species, their manner of growth and reproduction and wherewithal they are nourished; they will in short place in a clear light every thing that has reference to the different polypidoms and their formation, so that a department of natural history, so interesting, so new, and as yet only sketched in outline, may be rendered as perfect as it merits to be."*

The appeal, eloquent as it was and from one having great influence, was however made in vain; for whether from the inveteracy

oppose, n'etoit autre chose que de petits tuyaux contenant chacun un petit insecte."—Mem. de l'Acad. Roy. des Sc. an. 1742, p. 292.—Reaumur is still more explicit.: "Après avoir observé dans l'eau même de la mer plusieurs espèces de ces productions si bien conformées à la manière des plantes, il vit sortir des bouts de toutes leurs branches et de tous leurs nœuds, ou de toutes leurs articulations, de petits animaux qui, comme les polypes à paneche d'eau doucc, se donnoient tantôt plus, tantôt moins de mouvement, qui comme ceux-ci s'épanouissoient en certains temps, et qui dans d'autres rentroient en entier dans leur petite cellule, hors de laquelle leur partie postérieure ne se trouvoit jamais. Enfin, il (B. de Jussieu) reconnut que plusieurs espèces de ces corps, dont chacun avoit l'extérieur d'une très-belle plante, n'étoient que des assemblages d'un nombre prodigieux de cellules de polypes; en un mot, que plusieurs de ces productions de la mer, que tous les botanistes que les ont décrites ont prises pour des plantes, et ont fait représenter comme telles avec complaisance, n'étoient que des polypiers."—Preface, vol. vi. p. 71, 72. See also Amoenitates Academicæ, Vol. i. p. 185, for an enumeration of the species of Sertularia, &c., which Jussieu had examined, and considered to be animal productions. His account, however, of the animal of the Sertulariæ is altogether erroneous.

* Memoires pour servir à l' histoire des Insectes. Tome sixieme, Paris, 1742. Quarto. Preface from p. 68 to p. 80.

of habit and our fondness of opinions long cherished, or from the fewness of the published observations whence the general conclusion was drawn, it seems certain that the new doctrines were everywhere received with doubts and suspicion, and beyond the immediate sphere of the Parisian academy, excited apparently so little interest, that no one was induced to enter into a practical examination of them. Donati indeed shortly after gave a minute and accurate description of the coral and its polypes, and a somewhat less detailed one of the madrepores, but his phraseology being botanical and his opinions unformed, * his researches were of little immediate service to the cause of the zoologists, and perhaps rather tended to support the erroneous hypothesis which they were combating.†

Peyssonnel was still living, and it was impossible that this discussion should not interest him. Accordingly we find that in 1751, he transmitted to the Royal Society of London a MSS. treatise on coral and other marine productions,‡ of which Dr Watson has given a review in the 47th volume of its Transactions, published in 1753. The treatise was sent to the English society, because "that in France some lovers of natural history do attribute and even appropriate to themselves his labours and his discoveries, of which they have had the communication;"—a charge probably directed against Reaumur, but which the conduct of that illustrious man, so far as appears, did not warrant. The treatise contains upwards of 400 quarto pages, and is the result of the observations of above thirty years, but we

* Shortly after this, however, he made other observations which convinced him of the animality of coral. He says—"I am now of opinion, that coral is nothing else than a real animal, which has a very great number of heads. I consider the polypes of coral as the heads of the animal. This animal has a bone ramified in the shape of a shrub. This bone is covered with a kind of flesh, which is the flesh of the animal. My observations have discovered to me several analogies between the animals of kinds approaching to this. There are, for instance, Keratophyta, which do not differ from coral, except in the bone, or part that forms the prop of the animal. In the coral it is testaceous, and in the Keratophyta it is horny."—Phil. Trans. (1757) abridg. xi. p. 83.

† New Discoveries relating to the History of Coral, by Dr Vitaliano Donati. Translated from the French, by Tho. Stack, M. D. F. R. S. (Feb. 7. 1750.)—Phil. Trans. Vol. xlvii. p. 95. Haller characterizes the original as "nobile opus, ex proprio labore natum."—Bib. Bot. ii. 400.

‡ Traité du corail, contenant les nouvelles decouvertes, qu'on a fait sur le corail, les pores, madrepores, scharras, litophitons, eponges, et autres corps et productions, que la mer fournit, pour servir à l'histoire naturelle de la mer. By the Sieur de Peyssonnel, M. D. Correspondent of the Royal Academy of Sciences of Paris, of that of Montpelier, and of that of Belles Lettres at Marseilles. This treatise was never published.

find in it no facts in support of his theory additional to those already mentioned, for the greater portion of it is occupied with many details on the medical uses and other applications of coral which have no relation to the question at issue. It seems at first to have excited considerable attention among the members of the Royal Society, but Peyssonnel's endeavours were doomed ever to be unfortunate, for whatever favour his theory was likely to receive here was nipt in the bud by the opposition of Dr Parsons, a naturalist of considerable eminence, and an active member of the society. The analysis of Peyssonnel's treatise was read in May 1752, and in June of the same year, Dr Parsons read his answer,* which savours much of the supercilious dogmatism of a sceptical philosophy. He does not pretend that he had tested the doctrine of Peyssonnel by any experiments or observations, nor does he question his veracity, but he chose to consider the animals observed by Peyssonnel in the coral and madrepores as merely accidental settlers which had nothing to do with their growth, there being no "seeming power, proportion, and stability" in the polypes to render them capable of performing such works as they were thought to have done. "And indeed it would seem to me," says the learned Doctor, "much more difficult to conceive, that so fine an arrangement of parts, such masses as these bodies consist of, and such regular ramifications in some, and such well-contrived organs to serve for vegetation in others, should be the operations of little, poor, helpless, jelly-like animals, rather than the work of more sure vegetation, which carries on the growth of the tallest and largest trees with the same natural ease and influence, as the minutest plant."

But the progress of truth, although it may be delayed by opposition, cannot be permanently arrested. The converts to the new doctrines were indeed few, but much had been done to facilitate their future reception, for the slumber of prejudice had been broken, the hold of the ancient opinions on the affections had been loosened, and men no longer startled into scepticism when they heard of animals that in their productions mimicked the most beautiful and delicate vegetable forms.† The mind of naturalists was thus in some

* A Letter from James Parsons, M. D. F. R. S. to the Rev. Mr Birch, Secr. R. S. concerning the Formation of Corals, Corallines, &c. For an account of Dr Parsons's writings see Hall. Bib. Bot. ii. 340; and there is a short biographical notice of him in Phil. Trans. abridg. viii. 692.

† "For it is not because an opinion is true, that others will therefore adopt it. It must at the same time be congruous with our other impressions, and admit of being dovetailed into them, or it will be rejected; for it is judged of by its

measure prepared for the change on the very eve of being effected by the labours and assiduity of a member of that very society which had lately listened, with apparent approbation, to the reveries of Dr Parsons.

John Ellis—the name of the individual alluded to—was a merchant in London, who devoted his leisure to the study of natural history, in which he attained so considerable knowledge as to gain easy access to the Royal Society, and the acquaintance and correspondence of the most celebrated naturalists of his time. He seems to have attached himself more particularly to the economical department of botany, and seized every opportunity to introduce foreign plants to our gardens, especially such as were remarkable from furnishing any material employed in the arts and manufactures; and he was equally solicitous to acquire and diffuse accurate information relative to any natural productions which might be rendered subservient to the necessities or comforts of mankind. He was fond also of amusing himself in making imitations of landscapes by the curious and skilful disposition of delicate sea-weed and corallines on paper: and it was this amusement that directed his enquiries into the nature of the latter, for, attracted by their beauty and neatness, he was induced to examine them minutely with the microscope, by the aid of which he immediately perceived "that they differed not less from each other, in respect to their form, than they did in regard to their texture; and that, in many of them, this texture was such, as seemed to indicate their being more of an animal, than vegetable nature." These "suspicions," as he modestly terms them, were communicated to the Royal Society in June 1752; and, encouraged by some of the members, he prosecuted this enquiry with such ardour, and care, and sagacity, that in August of the same year, he had fully convinced himself "that these apparent plants were ramified animals, in their proper skins or cases, not locomotive, but fixed to shells of oysters, mussels, &c. and to Fucus's."*

conformity to the previous acquisitions, and is disliked and condemned if incompatible with them."—Turner, Sac. Hist. of the World, vol. ii. p. 19.

* See the Introduction to his Essay on the Corallines of Great Britain. It is from this work, and from the valuable "Selection of the Correspondence of Linnæus, and other naturalists, from the original manuscripts, by Sir James Edward Smith," 2 vols. 8vo. Lond. 1821, that I derive my account of Ellis's opinions. Sir J. E. Smith commences his memoir by saying—"John Ellis, F. R. S., illustrious for his *discovery* and complete demonstration of the animal nature of Corals and Corallines, was a native of Ireland." We have seen that he has no claim to this discovery, though he himself seems to have thought so, and never makes mention of his predecessors in the same field. A Professor Butt-

Ellis, however, was not forward to publish his discovery: he waited further opportunities to confirm the accuracy of his first observations, and to institute other experiments to remove whatever appeared hostile to the doctrine, which at length he fully explained to the members of the Royal Society in a paper read before them in June 1754; and it was made more generally known in the following year by the publication of his "Essay towards a natural history of the Corallines, and other marine productions of the like kind, commonly found on the coasts of Great Britain and Ireland;"—a work so complete and accurate that it remains an unscarred monument of his well-earned reputation as a philosophical inquirer, and is even to this day the principal source of our knowledge in this department of natural history.* In several essays presented subsequently to the Royal Society, and published in their Transactions, he continued to illustrate and extend his opinions, and defended them so successfully against his opponents, that they soon came to be very generally adopted.

There was nothing unformed nor mystical in Ellis's opinion. Certain marine productions which, under the names of Lithophyta and Keratophyta, had been arranged among vegetables, and were still very generally believed to be so, he maintained and proved with a most satisfactory fulness of evidence, to be entirely of an animal na-

ner at Gottingen, who had been in England, and become acquainted with Ellis, who calls him an "excellent botanist," unhesitatingly claimed Ellis's discoveries for his own, but a more bare-faced literary theft has not been recorded, and its detection has rendered the name of the German Professor infamous.—Lin. Corresp. vol. i. p. 170. and 179.—For a list of Ellis's writings the reader may consult Hall. Bib. Bot. ii. 433, and the Introd. to Soland. Zooph. p. viii.

* The concluding paragraph of this work may be quoted as throwing light on the character of this great naturalist—"And now, should it be asked, granting all this to be true, to what end has so much labour been bestowed in the demonstration? I can only answer, that as to me these disquisitions have opened new scenes of wonder and astonishment, in contemplating how varioulsy, how extensively life is distributed through the universe of things: so it is possible, that the facts here related, and these instances of nature animated in a part hitherto unsuspected, may excite the like pleasing ideas in others; and, in minds more capacious and penetrating, lead to farther discoveries, farther proofs (should such be wanting,) that One infinitely wise, good, all-powerful Being has made, and still upholds, the whole of what is good and perfect; and hence we may learn, that, if creatures of so low an order in the great scale of nature are endued with faculties that enable them to fill up their sphere of action with such propriety; we likewise, who are advanced so many gradations above them, owe to ourselves, and to Him who made us and all things, a constant application to acquire that degree of rectitude and perfection, to which we also are endued with faculties of attaining."

ture—the tenements and products of animals similar in many respects to the naked fresh-water polype. By examining them, in a living state, through an ordinary microscope, he saw these polypes in the denticles or cells of the zoophyte; he witnessed them display their tenacula for the capture of their prey,—their varied actions and sensibility to external impressions,—and their mode of propagation; he saw further that the little creatures were organically connected with the cells and could not remove from them, and that although each cell was appropriated to a single individual, yet was this united "by a tender thready line, to the fleshy part that occupies the middle of the whole coralline," and in this manner connected with all the individuals of that coralline. The conclusion was irresistible—the presumed plant was the skin or covering of a sort of miniature hydra,—a conclusion which Ellis strengthened by an examination of the covering separately, which, he said, was as much an animal structure as the nails or horns of beasts, or the shell of the tortoise, for it differs from "sea-plants in texture, as well as hardness, and likewise in their chemical productions. For sea-plants, properly so called, such as the Algæ, Fuci, &c. afford in distillation little or no traces of a volatile salt: whereas all the corallines afford a considerable quantity; and in burning yield a smell somewhat resembling that of burnt horn, and other animal substances; which of itself is a proof that this class of bodies, though it has the vegetable form, yet is not entirely of a vegetable nature."*

Ellis taught no novel doctrine, but he gave it fixidity and currency; and he moreover applied it to those very zoophytes which possessed the vegetable appearance in the most perfection, many of which he was the first to notice, and which he illustrated with a series of figures of unequalled accuracy.† He rarely went beyond the

* Dr Good is in error when he states that the ammoniacal smell from burnt zoophytes was the *principal* fact for placing them in the animal kingdom.—Book of Nature, i. 175 and 210.

† As mentioned above, Bernard de Jussieu knew that the Sertulariadæ—the zoophytes here alluded to—were animal productions, but no detailed account of his observations seems ever to have been published. Trembley had made the same discovery. Dr Watson, in his account of Peyssonnel's treatise in 1752, tells us that Mr Trembley shewed him, "at the late excellent Duke of Richmond's," the small white polypes of the Corallina minus ramosa alterna vice denticulata of Ray, "exactly in form resembling the fresh-water polype, but infinitely less." "When the water was still, these animals came forth, and moved their claws in search of their prey in various directions; but, upon the least motion of the glass, they instantly disappeared." P. 463.—Linnæus, however, in reference to the observations made previous to Ellis, says they are "inchoatæ, non ad plenum confectæ, et desiderentur adhuc quam plurima, quæ dies forte revelabit."—Amoen. Acad. vol. i. p. 186.

mere statement of the facts witnessed, or what seemed an unavoidable inference from them; but, perhaps, he deserted his usual caution when, from analogy principally, he asserted that the articulated calcareous corallines (Corallina, *Lin.*) and sponges, of a very different structure from coral, madrepore, or the horny corallines, were also like them, manifestly the places of abode of different species of polypes. In the former (Corallina) he had indeed detected some slender fibres which, it was presumed, might be parts of polypes, but this observation he was never able to confirm, and it was rather because of the porous structure of the corallines, than from any thing else, that he inferred the existence of polypes in them,—a structure which he had examined with minute accuracy and shown to be essentially different from any known vegetable tissue,—and, secondly, because of their chemical constituents, of which he procured an accurate analysis to be made.—With regard to the Sponges, Ellis, as Peyssonnel had previously done, supposed at first that the regular holes observable in dry specimens, strongly indicated their being once filled with animals; but when after repeated examinations of recent sponge, he could detect none, this conjecture was abandoned, and so thoroughly was he afterwards satisfied of the non-existence of animalcules, that he combated the opinion of those who maintained the contrary, pointing out where the error lay in mistaking small insects which had crept into the sponge in search of food or shelter for the real inhabitants and fabricators of the zoophyte. Yet not the less was Ellis convinced of its animality;—its chemical constituents and its structure were to him conclusive proofs of this fact, particularly when added to the signs of irritability he saw them exhibit when in a fresh state. "I am persuaded," he writes to Linnæus, "the *fibræ intertextæ* of sponges are only the tendons that enclose a gelatinous substance, which is the flesh of the sponge. Mr Solander and I have seen the holes or sphincters in some of our sponges, taken out of the sea, open and shut while they were kept in sea-water; but discovered no animal like a polype, as in the Alcyonium manus mortui." And again—"I attended last summer in pursuit of the animals in sponges, but believe me there are none: but the whole is an animal, and the water passes in a stream through the holes, to and fro, in each papilla."*

* Lin. Corresp. vol. i. p. 161, and p. 163. In a subsequent letter Ellis explains himself more fully. "I am now looking into the nature of sponges, and think by dissecting and comparing them with what I have seen recent, and with the *Alcyonium manus mortua*, that I can plainly see how they grow; without trusting to Peyssonell's account of them, which is printed in our Philosophical

When Ellis published these discoveries, which form in fact an epoch in the history of natural science,* Linnæus was in the zenith of his reputation,—the "prince of naturalists," as his followers loved to style him,—from whose decision on all disputed points in natural history, there was scarcely an admissible appeal. And Linnæus almost merited this distinction, for he was a man not only of superior capacity and acquirements, of great sagacity, ready apprehension, and fruitful fancy, but he was also of a candid and liberal disposition; and the ingenious labours of Ellis received from him great and merited commendation. He had previously, in the belief that lime was never formed but by animals, placed the Lithophyta in the animal kingdom; and he now adopted the opinions of Ellis so far as to include in it the horny and flexible polypidoms also, but at the same time he broached the conjecture, for it deserves no higher praise, that these were really intermediate between the animal and vegetable kingdoms, so that it could not be said they properly belonged to either. The animalcules of the Lithophyta, like the testaceous tribes, he said, fabricated their own calcareous polypidom, forming the whole mass into tubes, each ending on the surface in pores or cells, where alone the animal seems to dwell; † but the polypes of the proper Zoophyta, so far from constructing their plant-like polypidoms, were, on the contrary, the production or ef-

Transactions, wherein he pretends to tell you, that he takes the animal out of them, that forms them; and that he put it into them, and it crept about through the meanders of the sponge. This kind of insect, which harbours in sponges, I have seen; but sponges have no such animals to give them life, and to form them. Their mouths are open tubes all over their surfaces, not furnished, like the tubes of the *Alcyonium manus mortua*, with polype-like mouths or suckers. With their mouths they draw in and send out the water; they can contract and dilate them at will, and the Count Marsigli has (though he thought them plants) confirmed me in my opinion, that this is their manner of feeding. If you observe what he has wrote on sponges in his Histoire de la Mer, and the observations he has made on the Systole and Diastole of these holes in Sponges, during the time they are full of water, you will be of my opinion. Take a lobe of the officinal sponge, and cut it through perpendicularly and horizontally, and you will observe how near the disposition of the tubes are to the figure I have given of the sections of the Alcyonium manus mortua in my plate of the Sea-Pens."—Lin. Corresp. vol. i. p. 79–80.

* The Royal Society adjudged to Ellis the Copley medal, "as the most public mark that the Council can give of their high sense of the great accession which natural knowledge has received from your most ingenious and accurate investigations." The medal was delivered to him, Nov. 30, 1768, by Sir John Pringle, the President.—Soland. Zooph. Introd. p. xi.

† Lithophyta—"animalia mollusca, composita. Corallium calcareum, fixum, quod inædificarunt animalia affixa."—Syst. 1270.

florescences of it, * just as the flowers do not make the herb or tree but are the results of the vegetative life proceeding to perfection. Polypes, according to this fancy, bore the same relation to their polypidom that flowers do to the trunk and branches of the tree; both grew by vegetation, but while the one evolved from the extremities blossoms which shrunk not under external irritations and were therefore properly flowers,—the other put forth flowers which, because they exhibited every sign of animality, were therefore with reason considered animals. "Zoophyta," he writes to Ellis, "are constructed very differently, living by a mere vegetable life, and are increased every year under their bark, like trees, as appears from the annual rings in a section of the trunk of a Gorgonia. They are therefore vegetables, with flowers like small animals, which you have most beautifully delineated. All submarine plants are nourished by pores, not by roots, as we learn from Fuci. As zoophytes are, many of them, covered with a stony coat, the Creator has been pleased that they should receive nourishment by their naked flowers. He has therefore furnished each with a pore, which we call a mouth. All living beings enjoy some motion. The zoophytes mostly live in the perfectly undisturbed abyss of the ocean. They cannot therefore partake of that motion, which trees and herbs receive from the agitation of the air. Hence the Creator has granted them a nervous system, that they may spontaneously move at pleasure. Their lower part becomes hardened and dead, like the solid wood of a tree. The surface, under the bark, is every year furnished with a new living layer, as in the vegetable kingdom. Thus they grow and increase; and may even be truly called vegetables, as having flowers, producing capsules, &c. Yet as they are endowed with sensation, and voluntary motion, they must be called, as they are, animals; for animals differ from plants merely in having a sentient nervous system, with voluntary motion; nor are there any other limits between the two. Those therefore who esteem these animalcules to be distinct from their stalk, in my opinion, founded on observation, deceive and are deceived." †

* Zoophyta—"animalia composita, efflorescentia. Stirps vegetans, metamorphosi transiens in florens Animal."—Syst. 1287. "Zoophyta non sunt, uti Lithophyta, auctores suæ testæ; sed Testa ipsorum; sunt enim corpora (uti flores) imprimis generationis organa, adjectis nonnullis oris motusque instrumentis, ut motum, quem extrinsecus non habent, a se ipsis obtineant."—Syst. Nat. edit. 10. 799. When Berkenhout translates the first of these definitions—"stems vegetating and changing into animals;" Synop. i. 15, he certainly departs, if not from the letter, yet from the meaning of Linnæus.

† Lin. Corresp. vol. i. p. 151-2.

There was something in this hypothesis peculiarly captivating to an imaginative mind, and few poets have possessed a richer fancy than Linnæus. He seems to have ever fondly cherished the opinion, for in his curious Diary, in which he has enumerated with much complacency all his works and merits, it is mentioned as one of his principal recommendations to the respect of posterity. "Linnè," he says, "decided that they (zoophytes) were between vegetables and animals: vegetables with respect to their stems, and animals with respect to their florescence. This idea is still entertained." * Before we notice the manner of its reception by Ellis, we may take a short review of the writings of some other of the opponents of the latter naturalist.

Ellis had indeed effected a revolution in the opinions of scentific men, but there were some even of considerable reputation who either wavered between the old and new, or continued to hold the notions of their fathers, † which, however, very few ventured to maintain publicly. Of these the only one who merits our particular notice is Dr Job Baster of Zurichsee in Zealand, who seems to have been very imperfectly qualified for the task he had undertaken. At first he boldly asserted the vegetability of all zoophytes, attempted to prove that the Sertulariæ were really articulated Confervæ, and that the little animals observed on them were merely parasites, which had as little to do with the formation of the object they rested on, as the maggots in a mushroom had to do with its moonlight growth. These the results of his actual observation were set forth in a tone of arrogance calculated to wound the feelings and good fame of Ellis, nor is this conduct to be wondered at, for ignorance is usually as unfeeling as she is proverbially confident in her assertions, and the Dutch naturalist was truly very ignorant of all relating to the subject he attempted to elucidate. Unskilled in marine botany he actually mistook the objects of the enquiry, and instead of Sertulariæ set himself to examine true Confervæ,—a fact which the drawings illustrative of his paper demonstrate. His further experiments made him fully aware of this ridiculous error; and having become better acquainted with his subject, he appears to have been puzzled what to make of zoophytes; they were certainly not sea-weeds,—and it were too humiliating to adopt a once rejected theory,—when happily the Systema Naturæ came to his aid,

* Pulteney's General view of the Writings of Linnæus, by Dr Maton, p. 560. Lond. 1805.

† Count Ginanni was one of these, and had the hardihood to question the accuracy and observations of even Jussieu.—See Hall. Bib. Bot. ii. 444.

and he instantly adopted with zeal the vegeto-animal fancy, because, he says, it illustrated in a wonderful manner other things which were previously obscure and incomprehensible, and because it was in perfect keeping with the doctrine which taught that animated beings were a series of links constituting one long chain that could not be broken without violation to the continuity of organization,—the different species being so closely connected on this side and that, that neither sense nor imagination can detect the line which separates one from the other. It must be allowed that in Baster the doctrine of Linnæus has found its best advocate. He tells us that in zoophytes there are too many signs of a perfect vegetation to permit us to believe that they can owe their origin to animalcules so minute as to require a microscope to see them, and the great simplicity of whose organization altogether unfits them for perfecting such works: and as from the law of continuity indicated above it was reasonable to presume the existence of beings in which the distinctions between animals and plants should meet and amalgamate, so by a comparison of their definitions it may be made obvious that these distinctions disappear in zoophytes. A plant is an organized body without sense or spontaneous motion, adhering by means of a root to some foreign substance whence it derives the material of its life and increase: an animal, on the contrary, is an organized body endowed with sensation and perception, which can, of its own free will, make certain movements peculiar to itself. Like the plant, zoophytes grow fixed by a root; and yet at the same time they are animals, for they shew when touched that they feel by some motion, and when they perceive food proper for them they seize and devour it by the action of certain members.

Having in this manner commended the theory to our favour, and shewn its reasonableness and consonance to nature, Baster goes on to explain the manner in which he conceives his experiments prove that the Sertulariadæ or flexible corallines grow. The ova or seeds of these zoophytes, he asserts, pululate from the body of the mother in the likeness of tender articulations or new branches, which fall off on maturity, and adhere to any stone, shell, or other hard body, by which they are protected until the young are excluded. Now the outer coat of this egg or seed is of a *vegetable* nature, and it throws out from the sides, in the manner of other seeds, certain little roots by means of which it remains permanently attached; but the internal part of the egg or seed is *animal*, and growing simultaneously with its vegetable covering, it is dispersed through all the ramifications and occupies their hollow interior, being de-

veloped into polypes in the lateral denticles and extreme cells. Such was the deduction he came to from observations made on the growth more especially of the Sertularia abietina, which he had kept alive for nearly four months in a vessel of sea water. When a new part was formed, there first emerged from the stem a minute tubular joint, which rose to four, five, or even eight lines in height: after some days some lesser buds, regularly disposed in an alternate manner, were seen on the sides of this branch, which in the course of four or six days grew into cells containing perfect polypes. Hence it is obvious to Baster that the stem of this and similar zoophytes grows in thickness and length as plants do, and that the medullary pith is animal, which it is not wonderful should assume a dendroidal form, when we see zinc and quicksilver do the same by the mere force of affinity. Trembley had already pronounced the cells of the fresh-water zoophytes (Plumatella) to be not the work of the polypes, but rather compartments in which they concealed a part of their body; and this fact, added to those already given, makes it certain that the animalcules of the Sertulariadæ are entirely passive, and have no more to do with their polypidoms than the flower has with the increase and growth of the herb. *

There is some ambiguity in Baster's statement of his opinions, for it is not very obvious whether he believed the new formed branchlets to be themselves the eggs or seeds, or whether they only contained the eggs; but be this as it may, it appears scarcely doubtful that he knew nothing of the true ova and their curious ovaries. The phenomena observed in the production of new parts are correctly stated, but nothing but wilful prejudice could blind him to the fallacy of the consequent reasoning. The analogy attempted to be drawn between the eggs of zoophytes and the seeds of plants has no existence, for every tyro knows well that the coat or skin of seed in no instance ever pushes forth radicle fibres, or ever exhibits any sign of vegetation;—it is a dead part which is cast off or corrupts, and exerts no further influence on vegetation than as a protection to the cotyledons and embryo which it invests, so that if it is true that the coat of the ova of zoophytes is the source of their vegetative part, as Baster says, that coat must be of a very different nature from the skin of seeds. It would have been better to have compared the oviform bodies of the zoophyte with the buds of the tree, and he might have disported with this fancy to some effect, for there are many analogical resemblances, and the inapplica-

* Phil. Trans. vol. lii. p. 108–118.—For Baster's works see Hall. Bib. Bot. i. 468.

bility of the illustration is not so very plain. Still it is inapplicable, for buds grow from the absorption of water and inorganic matter which is diffused and assimilated by means of a certain determinate organization, while the covering of zoophytes receives no increase except through the medium of its polypes;—it has no sap-vessels, no spiral tubes, no cellular parenchyma, no absorbent roots, no pores and spiracles on the surface, so that all its material must be derived from an internal source; and to say that a body vegetates when the nutriment is received and assimilated in a different manner and by a different structure from what it is in plants, and is productive in its assimilation of opposite principles, is to use terms in so vague a sense as would be intolerable in any science.

Neither the authority of Linnæus, nor the imperfect experiments of Baster had any effect on Ellis, who steadily opposed this vegeto-animal doctrine, and whose superior knowledge made it easy for him to detect and point out the erroneousness of the observations on which it principally rested. In reference to the opinion itself he wrote to Linnæus,—"artful people may puzzle the vulgar, and tell us that the more hairy a man is, and the longer his nails grow, he is more of a vegetable than a man who shaves his hair or cuts his nails;* that frogs bud like trees, when they are tadpoles; and caterpillars blossom into butterflies. These are pretty rhapsodies for a Bonnet. Though there are different manners of growth in the different parts of the same animal, which the world has long been acquainted with, why should we endeavour to confound the ideas of vegetable and animal substances, in the minds of people that we would willingly instruct in these matters?"† And in a subsequent letter he repeats, "I cannot reconcile myself to vegetating animals: the introduction of the doctrine of this mixed kind of life will only confuse our ideas of Nature. We have not proof sufficient to determine it; and I am averse to hypotheses."‡

* Bohadsch in answer to those who believed that the Pennatulæ were plants uses the same argument.—De Anim. Mar. p. 123. This author, who wrote in 1761, was a strenuous advocate for the unmixed animality of zoophytes.

† Lin. Corresp. Vol. i. p. 226. ‡ Ibid. p. 260.

(To be continued.)

REVIEWS AND CRITICAL ANALYSIS.

I.—*Iconographia della Fauna Italica.* Di Carlo Luciano Bonaparte, Principe di Musignano. Folio. Parts 1 to 12. Rome. Agent in London, Havell, Oxford Street.

We cannot describe the pleasure with which we undertake the office of introducing this valuable and most interesting work to such of our readers as may not have met with it. A few years ago, whilst revelling in the enjoyment of the amenity and tranquillity the imperial city affords, and regaling in the feasts afforded by the daily inspection of its masterpieces of ancient and modern art, it never occurred to us, that we should be so soon called on to announce the commencement of a new era, in the facilitating the researches of those who vary the scenes of mental relaxation, by the pursuit of natural science. The lead in this most desirable change has been taken by the Prince of Musignano, who is better known to the public by the more familiar, and to our ears, we confess, more agreeably sounding name of Charles Bonaparte. His father Lucien, as is well known, has long been settled in the Papal states, where he is a landed proprietor, and after resisting the temptations of high titles, offered in the great and palmy state of the empire, has retired with the rank of a Roman noble. The public are likely to be very much indebted to him for the discovery and investigation of antiquities, which have been found on his lands in the ancient Etruria, and will probably prove of great importance in clearing up parts of the ancient history of Italy. Of that numerous family, all of whom are possessed of talent, and are well educated, with the desire of distinction inherent in them, we believe the Prince of Musignano alone has given his time to the regular and systematic pursuit of natural history.

After the disaster of 1815, the Prince accompanied some part of his family to the United States, where his well-known work, "the continuation of Wilson's North American Ornithology," was published. He returned to Europe in 1828, and immediately afterwards

gave the "Spechio Comparativo," a little comparative sketch of the birds of Rome with those of North America, to which a supplement was added. Subsequently, a system of classification of the animal kingdom, with remarks on that of Cuvier, and some minor opusculi, were printed at Rome, but we believe these works were principally, if not wholly, intended for private distribution amongst his friends.

In the winter of 1832–33, the present more serious undertaking was commenced. It consists of a selection of the new or remarkable species in the Mammalia, birds, fishes, and reptiles, of Italy and the adjacent countries, which are given in coloured lithography, with descriptions in the vernacular idiom. The work may be classed amongst those "of luxury," in the phrase of our neighbours. The size is folio, the printing admirable, and reflects the more credit on the Roman typography, that it is the first attempt on that scale and subject. The policy of the Papal government has always been to discourage printing, and in consequence, the profits of an art which would appear to be particularly suited to the place, have been abandoned to the Tuscans and Lombards, who have almost monopolized the printing even of the standard classic works, to which no inquisitorial objection could be made, whilst the public press of Rome has been chiefly employed in the most common-place work of missals or breviaries, more for the use of the strangers than of the natives, for whom a very small supply of these articles is sufficient. The editing a work of this sort, and passing it through the hands of such assistants, is of course considerable, and enhances the interest of it. The same remark applies to the designs, which were executed under the personal inspection of the Prince; and his draftsmen making their first essay in this work, and his villa, (which formerly belonged to Paulina, the Princess Borghese, and is situated just within the walls,) when his assistants were at work resembled a small academy. The fish and reptiles are the best executed, the quadrupeds are good, the birds perhaps the most defective, clearly owing to the difficulty, even to the experienced hand and eye, of seizing and embodying the graceful, lively, and ever-changing attitudes of the feathered part of the creation. The style is excellent, the clearness and ductility, as well as extreme conciseness of the Italian, adapting it singularly to the uses of natural history.

The work commences with a plate and description of the common fox of Rome and the vicinity, which the Prince has made out to differ from the Canis vulpes, the inhabitant of our own islands, and of the centre and north of Europe, and to which he has given the name of Canis melanogaster. The chief organic difference ap-

pears to be in the size of the head, which, instead of being one-fourth of the length of the body as in C. vulpes, approaches to one-third. The fore paws are much shorter than in the other species, whilst those behind are equal, thus making the respective difference of the fore-arm greater. The ears are shorter than in the C. vulpes; and Professor Savi has noticed a peculiarity, which, if it be constant, is rather singular. The young of the C. vulpes, when first whelped, have the hair long and whitish, whilst in the new species it is short and of an ash-gray colour. We may add that, in our own opinion, the proportions and general appearance of the animal are different; the head being larger, and the tail very bushy, alter his port and bearing. The Roman fox in winter has the under parts of the belly, breast, tail, back of the ears, part of the paws, and under jaw, black, the other parts of the body being tawny. In summer the black parts change to white, thus inverting the general order of nature as we approach the north. On this winter colour the name has been founded; but independently of the general objection to the adoption of colour as a distinctive appellation, there are two very strong ones to using it in this instance; the one, that it is by no means constant, the same individual varying in intensity of colour from one year to another, probably from age, or health, or diet, the other that in Nilson's Fauna Scandinavia, an individual of C. vulpes is figured which had precisely the colour of the C. melanogaster; and within our observation we remember assisting at the death of a fox which had been maimed by a trap; it had a quantity of black in different parts of the body, differing very much from the common appearance of its brethren. For these reasons we think the name had better have been selected from some of the points of organic difference, than from the fleeting and uncertain one of colour. The author considers that his species resembles the C. fulvus of Desmarest, an American fox, more nearly than any other. The C. Niloticus of the French Institute, might be supposed to be identical, from the contiguity of regions, but the osteology of the head is different, in the latter species.

The limits of the habitat of C. melanogaster are not yet exactly defined, but would appear to be those of the great southern zone of Europe, which comprises Italy south of the Apennines, Greece, the south of Spain, and the Islands of the Mediterranean. Like the peasantry in other places, the Romans consider that there are two species of the common fox, the one not eatable, the other, which is called, "Leprene," probably from its fancied resemblance to the flavour of the hare, being admitted to the table. Not having made the trial, we agree with the Prince, "de gustibus," &c.

We were not surprised at this distinction of species, having long suspected that the timid, half-domestic animal of the campagna of Rome although our earliest acquaintance as the fox of Æsop and Phædrus, was of inferior caste to our noble reynard, which, in fact, would scarcely acknowledge his congener if he knew his habits. So cowardly are they, that our young countrymen at Rome, after establishing a pack of hounds, and struggling through several seasons with the perseverance of John Bull in his favourite diversion, found it impracticable to raise a run, and were forced to adopt the more humble but sure mode of obtaining sport, by turning off a cur at some distance from the city, and following him over hedge and ditch as he made his way back to his hovel. We speak feelingly on this subject, as it was a serious inconvenience to those whose avocations obliged them occasionally to use the steeds of the Piazza del Popolo, which were constantly either engaged at double prices, or lamed in consequence of their exertions at the Caccia Inglesa.

We are indebted to Professor Savi of Pisa for the interesting discovery of the species of mole which is beyond doubt the Ασπαλαξ of the ancient Greeks, and has the appearance and reputation of being blind, whence the appellation, Talpa cœca, has been conferred on it.

In general external character and appearance there is no difference between this species and the T. Europæa, which infests our fields. The Professor considered it to be smaller, but his specimens were brought from the high Apennines, where in all probability food is more scarce than in the plains, and the Prince has found that in a number of specimens taken in the campagna of Rome there was no difference in this respect.

There is a small dissimilarity in the dentition, which we should scarcely look for in species differing so little as these two. In T. Europæa the incisors are all equal, but in T. cœca, the two anterior teeth are longer than the others. The striking distinction, however, is in the eye being covered entirely by an unperforated bare skin, through which the black is seen on close inspection. At first sight it would appear that this skin would preclude the power of vision; but we have no doubt whatever, that the animal possesses the power of dilating this membrane, and, however imperfect, has the light necessary for its use, when it choses to extend it. It is highly probable the vision is as good as that of its congener, whilst the eye is better protected. It may not be easy to prove, but we think it not impracticable to ascertain exactly whether it be so, and we wish the Professor had proved his mole to be blind before he conferred an ap-

pellation the poor animal most probably does not deserve. Its name drawn from antiquity would have been more appropriate in every respect—why not Talpa aspalax or Talpa Aristotelis?

The habitat is probably the same as that of the C. melanogaster, but is not yet exactly ascertained.

In the third number we have a species of rat, which in Italy represents the Mus rattus, the old English rat, now so nearly extinct. Neither species are indigenous in their respective countries, nor of long standing, although their origin and time of introduction are not certainly known. Like the black rat its territories have been invaded by the Mus decumanus (our common rat), but, being stronger and more courageous than its congener, it has escaped extermination by that ruthless race. In many places they occupy the same ground, but are at all times in a state of determined hostility. The Italian species differs from M. decumanus in the length of the tail, which is greater than that of the head and body together, and from M. rattus with which it has that characteristic in common, in colour and other particulars. It would appear to resemble the M. Alexandrinus of Geoffroy, an Egyptian species, but the Prince has never been able to compare them together. We owe the separation of this species from that of M. rattus, with which it had always been confounded, to Professor Savi. The name of M. tectorum, equivalent to that of the trivial one in Tuscany, has been assigned to it, from its living a good deal about the roofs of the houses. It sallies into the gardens during a part of the year, and in general, haunts dry situations, differing from the M. decumanus, to which every one wet or dry seems alike indifferent.

The region inhabited by it seems to be that south of the Apennines, the M. rattus occupying the plain of Lombardy and circumjacent countries. The origin is unknown, as before mentioned, and its introduction modern. The ancients appear only to have been acquainted with the common mouse (Mus musculus); but we have no doubt, it, has with so much of good and evil been imported from the East.

In a subsequent number we have an account of the Arvicolæ, field rats and mice, which are properly separated from the Mures, or those addicted to living in or about habitations.

The Mus terrestris of Linnæus, Arvicola terrestris of our author, which was supposed to be principally confined to the neighbourhood of Strasburg, is common in many parts of Italy, especially near Grosseto, a district in the maremme of Tuscany, which was an almost uninhabitable marsh until very lately, when extensive drainage has

restored it to cultivation, like Leghorn and some other parts of the same territory. Its habits are half amphibious, and in this description of country it is dreadfully destructive to the embankments, by burrowing and destroying the newly made works. Like the water-rat, which it very nearly resembles in many particulars, its excavations are made principally with the mouth, the claws being little used, the burrows are long and parallel to each other, with side galleries.

The food is exclusively vegetable, and its ravages are so great in gardens and vineyards by gnawing the young shoots, that the price paid for its destruction at Rome, is one-half more than that of the mole, and twelve times that of the short-tailed field-mouse, which is only four times smaller. They are taken by a hollow tube, which is placed at the entrance of the burrow, the passage being obstructed by a bundle of grass, in eating through which an elastic rod is loosened, and the animal taken by the neck. It appears to change the habitat according to the rains, leaving the low country when it is inundated, and gradually advancing as the waters subside. It is a favourite food of many animals, especially of the foxes, which watch at night in the gardens, and on hearing them work in the burrows, suddenly scratch in and take them out, thus destroying plants and causing other serious damages—in addition to that committed by the rat itself.

The Arvicola arvalis, short-tailed field-mouse, is common in Italy, and in some parts is taken in almost incredible numbers.

The water-rat, Arvicola ampihibia, is also very common. It differs from the A. terrestris, besides other respects, in being extremely carnivorous.* The head is shorter, and the muzzle more pointed than in its congener, and there are differences in the dentition, which are carefully pointed out and engraved.

The common marten, Mustela martes, is not uncommon near Rome, frequenting even the hot and burning region at the mouth of the Tibur, where it is found in the lofty stone pines of the villas there.

The common otter, Lutra vulgaris, also inhabits the Tibur and Anio, being found occasionally even within the walls of Rome, where it is most acceptable in Lent, the strange and convenient doctrine being admitted that these animals, as well as some sorts of wild fowl, are cold-blooded, and consequently admissible as food on the fast days!

The mufflon, muffione or musmon, Capra musmon, is engraved and described in the ninth number. It is no longer found in the Italian peninsula, as it formerly no doubt was, and we are not satisfied that it exists in the European Continent, unless it be in some part of Turkey. There are still a few in Corsica and Sardinia. It

* In Britain the A. amphibia is almost entirely herbivorous.—Ed.

claims to be the parent of the common sheep, but the number of joints in the tail, which in the C. musmon are twelve, whilst in the domestic sheep they are nineteen or twenty, are almost conclusive against their identity, and in the absence of absolute proof, we should be disposed to favour the claim of the Argali, the Capra Ammon of Fischer, the native country of which is Tibet and Tartary, where in all probability it was brought into subjection by the ancient race of shepherds long before the discovery of the European species.

In the ophidians, the author has adopted a modification of the arrangement of Wagler. The Colubrini, comprising the harmless serpents of Europe, is subdivided into Natrix, which has the scales carinated. They are chiefly aquatic in their habits. Coronella, which has the body very taper and the tail long, the scales of some being carinated, and others not. They principally inhabit trees. While Coluber includes those with the scales imbricated and smooth, the tail being of moderate length.

The first reptile described is the Coluber Riccioli of Metaxa a physician, who published a monograph of the Roman serpents, and we believe first described it. It is one of the most beautiful, and at the same time one of the most harmless and gentle of the tribe. It is so mild in disposition, that with difficulty it can be made to open its mouth when irritated. It is found in Monte Mario, in the suburbs of Rome, but it is not common. It has also been seen on the banks of the Garonne, probably inhabiting some of the intervening countries.

We were truly happy to find this species named after a most worthy and indefatigable individual, to whose zeal the naturalists at Rome are very much indebted. He had paid considerable attention to the reptiles, and we remember when visiting his repository, which was a most curious miscellany of objects collected in various parts, seeing a chest filled with living serpents, that were placed there to hybernate, for the purpose of making observations on their changes. As he discovered this Coluber, it was justly ascribed to him.

The Natrix gabina is another elegant species. The name was at first given in consequence of its being found amongst other localities at the small lake which fills an extinct crater near the site of the ancient Gabii. In a later number this name is corrected, the Prince having subsequently been satisfied that it is identical with the Coronella tessellata of Laurenti, the Coluber tessellatus of Gmelin, &c.

The habitats, which were at first supposed to be rather restricted, are now known to be considerably extended, comprising parts of Germany, Hungary, Spain, and France. The length is about three

feet. There is no difference in colour between the sexes. The back is a bottle green, with symmetrical rows of dark spots ; the under parts with dark spots on a light yellow ground, and red intermixed.

It inhabits ditches and similar situations, is extremely shy, and difficult of capture even to the most expert hunters of serpents.

The Coluber flavescens—is of considerable size, some specimens measuring forty inches. The back is dark green with white cross-shaped spots, the under part being of light greenish-yellow. The young differ extremely from the adults.

This is one of the species which claim the honour of being the attendant of Esculapius, but the Prince thinks without foundation. That named after the god of medicine by Linnæus is an American reptile, and that on which Lacepede bestowed the appellation had no better title than because it came from Rome. Whichsoever be the real species, we apprehend it must be sought for in Greece.

It inhabits all parts of Italy, living mostly in marshy meadows and about trees. We suspect it is found beyond the Alps ; a very large snake killed by us in a watery lane near Stang in Switzerland, some years since, as far as we can recollect, perfectly answering the description.

Three beautiful plates are given of the Coluber viridiflavus, a large and active reptile, which is found over the whole of the south of Europe. The author has seen a specimen four feet in length. It is the most common species near Rome, living even within the walls, and we can testify from ocular observation its activity in the capture of its prey. Amongst the plates is a variety of dark colour, which has been described as another species by the name of C. carbonarius. The author seems to think that reptiles living in mountainous districts assume a darker colour than those inhabiting the plains, a subject which is well worth the investigation as to the causes, and whether it be constant.

The Natrix elaphis is the largest European Ophidian, a specimen of five feet eight inches in length not being considered extraordinary. This is the reptile which is conjectured by Metaxa to have been that which is recorded to have swallowed a child on the Vatican mount in the time of Claudius, the body being taken out of the stomach uninjured. We do not think it at all incredible, and more likely to be true than otherwise. We remember seeing a very young child deposited on the pavement of a church at Lisbon, quite naked, to wait until some charitable person should order it to be buried, which a very moderate sized snake might have swallowed, had

it met with it in its haunts. This species is only seen in the south of Italy, and has not been observed even in Lombardy.

The Coluber leopardinus receives its appellation from the disposition and colours of the spots in its skin. It is the most beautiful of the European serpents, and is extremely gentle in its nature. The plate is well executed, and we believe it is the first time it has been figured. The principal habitat is Dalmatia, and it was supposed to be confined to that country, until Riccioli found it near Otranto. The best and almost only specimens are at Vienna. It is rather of large size, a moderate specimen measuring three feet four inches.

The Natrix torquata, our common hedge snake, is figured, with an excellent representation of the head in a state of expansion which the animal has the power of giving it.

The Natrix viperina, a species which inhabits Sardinia, and the South of France and Spain, has not yet been seen in Italy. It is the Coluber viperinus of Latreille, and is of small size.

The Coluber hippocrepis, which was described by Frederic Linnæus as an American species, was brought from Sardinia to the late Professor Bonelli of Turin, and by him described as new, and called Coluber sardus and C. diadema. The author believes it to be identical with a species brought from Algiers, and called by the French C. diadema. It is common in Sardinia and in Florence, but has not been seen in Italy.

The section of Vipers is one of exceeding interest. The author separates the sub-family of Viperina into six genera, two only being European. Vipera is separated from the Crotali, by the want of the fossets behind the eyes, which distinguish that deadly group.

The vipers are slow, their motions being almost exclusively horizontal, owing to the formation of the vertebræ, but they are capable of raising the head quickly to strike or wound, and we apprehend it is their principal mode of capturing their prey. They are unable to dart or spring forward, like some of their congeners. We give a specimen of the style in the description of this form.

" Oltre le già accennate sonovi altre condizioni comuni alle specie del genere Vipera, che meritano d'essere riferite piu alla distesa. Il capo è assai distinte dal tronco, di figura piriforme, depresso posteriormente, qualche poco compresso verso il dinanzi ; di sopra è appena convesso, non vestito di scudetti, ma d'un vario numero di squame picciole, ovate o ovate lanceolate, ottusa, irregolari nella forma e nella disposizione, tutte convesse ; quelle collocate nel tratto anteriore al vertice prive de carena, le restante segnate da una carena longitudinale risentita, talvolta alcune di quelle poste dietro al

punto intermedio fra gli occhi hanno proporzioni alquanto maggiori delle altre, ma fur sono imbricate e non rassembrano scudetti."

The author remarks, that, in the vipers and all other serpents, the male has the tail longer than the female, a want of attention to which character has given rise to the creation of new species; and added to the confusion already existing in the arrangement of these animals. The first viper described is the V. ammodytes, the peculiar distinction of which is in the muzzle being turned up somewhat in the manner of the horn of the rhinoceros. It is extremely venomous, being reputed to be more so than the common species, and in spring it is said to be dangerous to pass near it. It inhabits the Morea, Dalmatia, Hungary, and has been met with near Ferrara.

The Vipera aspis of Merrem and of our author, the Coluber aspis of Linnæus, is the common viper of Italy, and of the south and centre of France. The colour varies extremely, and of four plates in which eight individuals are admirably delineated, no two are alike. This is one and a natural cause of the confusion which exists even amongst the best writers in the accounts of these reptiles, and one of the many good points in this work is the number of synonyms and authorities which are given.

On the poison of this species the celebrated experiments of Fontana and others were made. We believe, after all, that the best and easiest cure is by immediate suction; care of course being taken that there are no open wounds or ulcers abouth the mouth. In all cases, the widest difference is produced by the age of the animal, the season of the year, or probably the *animus* with which its wound is inflicted; and still more important is the habit of body of the recipient, and the part where the poison has been injected. We know the serious and sometimes fatal effects that have resulted in this country from the sting of a single wasp or bee.

These reptiles are some years so numerous in the flat and marshy country below Massa di Carrara, that the entering the woods is attended with danger to the peasantry. In these cases we have been informed the mode resorted to is that of turning in herds of swine, which pursue them with such avidity, that in a very short time the nuisance is entirely abated.

The genus Pelias differs from Vipera in the head being depressed and extended backwards; it is covered with convex scales, and the snout is a little turned up. In Pelias the head is oval shaped, less depressed, and less sensibly separated from the body. It is covered with scales, which are flat or very slightly convex. The snout is flat and not relieved or turned up from the muzzle. In the words of the au-

thor " Solo in pochi punti differiscono fra loro i generi Vipera e Pelias. Laddove nel primo il capo è depresso, allargato posteriormente, coperto nella parte superiore di piastre o piuttosto squame convesse, lo spigolo rostrale è risentito, prominente sull' apice del muso; il Pelias ha il capo ovale, men depresso e men sensibilmente distinto dal tronco, coperto superiormente di scudetti piani anzi leggermente concavi, lo spigolo rostrale non è risentito, nè rilevato affalto sull' apice del muso." Subsequently he observes of Pelias:

" I moti di queste sono in paragone men lenti; l'indole loro è piu fiera ed al solito riescono assai piu pericolose, perchè, anche senza essere provocate, impetuosamente si slanciano e mordono."

This would appear to be the viper of Ray and Pennant, the Coluber berus and prester of Linnæus, C. chersea and Vipere commune of Cuvier, the Æsping of the Swedes, &c. &c. The number of names which have been collected by the Prince as synonyms of this species are remarkable, and we must say, not reconcilable to each other in all instances. The Vipere of Cuvier, for instance, does not agree with the reptile figured in this work. We have given the characters at length, in order to draw the attention of the reader to the elucidation of this genus. We strongly suspect that both Pelias and Vipera are to be found in this country. The writer of these observations has frequently killed the common viper on the moors in Northumberland, which is a very dark-coloured, slow and sluggish animal, moving from its coil when disturbed with great difficulty, and, it has always been found, basking in sunny dry places. On one occasion, whilst shooting in a district upon the Reed near the Carter Fell, in a deep fern bed, he met with a reptile, which in colour, form, and activity, differed so much from any he had seen before or since, that he was satisfied it was different from the common species. It was so active that there was great difficulty in securing it, and it bit at the gun-stock with uncommon virulence, but being at the time more intent in the pursuit of game than on that of natural history, he neglected preserving it. However, it agreed in every respect with the Pelias berus now described, and it is mentioned for the purpose of drawing the attention of those who may have opportunities of attending to the subject.

The common name of this animal in Italy is, Marasso palustre, to shew its habits of frequenting marshy districts, where it avoids the sun, keeping in the shade excepting in the early morning. It swims with great facility. It has not yet been seen south of the Apennines, but is found beyond the Alps. In the colouring in some of the lower parts there is a *citrine yellow tint*, which was one of the peculiarities

noticed in the specimen above-mentioned, which we never saw in what we call the common viper. In the Vertebrated Animals of Jenyns, which we have recently examined, it seems almost certain that amongst his varieties there are two species. Colour or size prove nothing, but the shape of the head, though loosely mentioned, is strong presumptive proof. Another Pelias is figured under the name of P. cherua, or Marasso alpino. A very small individual has furnished the description, and was brought from the mountains of Abruzzi, in the neighbourhood of Ascoli, where it inhabits dry stony places. We hope that, in a subsequent number, we shall have more ample information, for at present we do not think ourselves quite justified in admitting it to be a species.

We must defer the notice of the Ornithology and Ichthyology to another opportunity, having already extended this article quite sufficiently. We could wish that, in the subsequent numbers, some of the rarer birds, such as Turdus Naumanni, Turdus atrogularis, which are at Turin, the Sterna leucoptera, found by us at Rome, the Sylvia conspicillata, which the Prince met with near Civita Vecchia, were figured, as they possess some interest to the English reader who may not have access to the continental collections. We should likewise be glad to know whether the Accentor montanellus of Temminck really exists in the localities he mentions. We were not successful in seeing or hearing of it either at Rome or Naples.*

II.—*The English Flora.* By Sir J. E. Smith, M. D., F. R. S., &c. Vols. i.–iv. 1824–1828.

The British Flora. By W. J. Hooker, LL.D., F. R. S., &c. Vol. i. 3d Edition, 1835.

The English Flora. Vol. v. part i. (Or, the British Flora, Vol. ii. Part i.) By W. J. Hooker, LL.D., F. R. S., &c. 1833. Same works, Vol. i. Part ii. By W. J. Hooker, and Rev. M. J. Berkeley, M. A., F. L. S., &c. 1836.

Much as the botanical productions of the British isles have been investigated and written upon, during a period of nearly two centuries, we do not yet find the subject to be at all exhausted, either of interest or of novelty. Taken collectively, British botanists are yearly adding to the stores of their knowledge concerning the plants of their own country, whilst, individually, their numbers are rapidly increasing through the hosts of new votaries attracted, or (by the converting powers of some medical college) compelled, to become

* In the Supplement to his Manual, M. Temminck concludes his remarks upon Acc. montanellus "de passage accidentel en Hongrie, *et plus accidentellement encore dans le midi de l'Italie.*"—Ed.

worshippers of the gentle goddess, whose name now stands so conspicuous on so many botanical title-pages, and, for whose honour, such countless thousands of fair and fading flowers are annually metamorphosed into the more enduring and brunette mummies of the herbarium. Economists, without being very political, are sufficiently aware that an increasing number of consumers soon leads to an increased production of the articles consumed, to competition, to improved quality, and to cheapness;—advantages pressing upon each other in rapid succession. Thus has it been with the works descriptive of British botany, dating from the publication of the first volume of the English Flora, in 1824. Never before has there been so large a number of purchasers; never so many new, or newly arranged, works; and never so much of diversity and excellence in plan, arrangement, and execution. It would seem that we have now reached the point when a new Flora, in the full sense of the term *new*, has become impossible, and when there is scarcely any space left for thrusting in a newly dressed one. The two Floras, named at the head of this article, stand pre-eminent in utility to British botanists. The *English Flora* will long rank as a standard work of consultation, both on account of the number and accuracy (generally speaking) of the synonyms and references to other authors, and on account of the full and original descriptions of species. But this work being too bulky for the valise of the tourist, and too expensive for the pocket of the young student, a *Compendium of the English Flora*, was published in one thin 12mo volume, containing little more than the specific descriptions taken from the larger work, with the duration, time of flowering, and usual situation of each species, expressed by abbreviations. The same course had been followed with the *Flora Britannica*, of which the English Flora may be looked upon as an improved and enlarged translation. The smaller work, however, was insufficient without access to the larger, and the larger work was inconvenient in use without the smaller and more portable one. As a teacher of botany, it appears that Dr Hooker felt the want of some intermediate work, including sufficiently complete descriptions for enabling a student easily to determine the species, without being swelled to a voluminous size by references of little value to mere students. This happy medium, it must be allowed, has been successfully hit upon by the author of the *British Flora;* who has compressed into a single 8vo volume all the most essential points of description spread through the four volumes of the English Flora, besides effecting considerable improvements in some of them. So far, these works included only the flowering plants, belonging to the first twenty-three classes of the Linnean system, with the order

Filices of the class *Cryptogamia*. Death having prevented Sir J. Smith from continuing the English Flora through the Cryptogamic class (which appears to have been his wish,) Dr Hooker, with the assistance of others who have made cryptogamic plants their especial study, has now completed both the English Flora and British Flora, by the publication of one thick volume in two separate parts, the first part extending from the *Musci* to the *Algæ*, and the second part being devoted exclusively to the *Fungi*. This volume we are told to receive as the fifth and last of the English Flora, or, as the second and last of the British Flora. Though "ENGLISH FLORA, VOL. V." does figure in large letters on the title-page, the plan of the volume altogether corresponds with the plan of the British Flora, and is widely different from that of the English Flora; so that we are disposed to esteem it really the second volume of the former, and to receive it only as a nominal continuation of the English Flora:—a continuation, be it observed, which the learned author of the English Flora might have well been proud to acknowledge as his own. In this view of the double-titled volume,—a view pointed out by truth and justice, although it may not so well suit the booksellers' fancy, *Hooker's British Flora* must now be regarded as the only complete work on British plants; that is, complete as respects the knowledge acquired by botanists, not as respects the actual productions of nature; since there appears not a chance that we shall ever attain to complete knowledge of cryptogamic plants, and even yet, novelties are discovered every year among the conspicuous and much-hunted flowering plants.

A hasty glance over the steps, by which the literature of descriptive botany has arrived at its present stage of superiority and encouragement in Britain, will elucidate our remarks on the works before us. In the preface to the English Flora, we have a brief historical sketch of the older works in this department of botany, commencing with the *Phytologia* of Dr How, in 1650, and coming down to the publication of the Flora Britannica, in 1800; with notices of a few of the more recent work. It appears that fourteen descriptive Floras were published during this period of one hundred and fifty years. Amongst these, *Ray's Synopsis* and *Withering's Arrangement* reached to third editions, and *Hudson's Flora Anglica* and *Berkenhout's Synopsis* came to second editions; thus making twenty publications in all. To this number we may add about half a dozen others, the names of which appear in catalogues, though not mentioned in the historical sketch; and also the first edition of *Hull's British Flora*, if published in 1799. Of this latter work, a

second edition has since appeared. The *Flora Britannica* and *Compendium* of Smith, a translation of the latter by Galpine, *Thornton's British Flora* (a work known to us by name only,) *Gray's Natural Arrangement of British Plants, Salisbury's Botanist's Companion*, the two works at the head of this article, the *Compendium of the English Flora*, *Lindley's Synopsis of the British Flora*, in two editions; with five full-sized editions of *Withering's Arrangement*, and three smaller ones by Macgillivray, make up a number of publications, inclusively of different editions, during the present century, equalling the whole number of those heretofore published; and two-thirds of which have appeared in the course of the last twelve years. The two standard works of plates, illustrating our native species, *English Botany* and the *Flora Londinensis*, were commenced in the last century; but a new issue of the former is now in progress. Other illustrative works are also publishing in periodical numbers.

We may date the present era of British botany from the publication of the first volume of the English Flora, in 1824; since it cannot be doubted but this work gave a decided impulse to the study of British plants, by presenting a standard and authoritative work, in our own language; calculated to supersede that of Withering; which was useful enough in its day, but is now almost obsolete as a work of science, although bearing a name still very good for the book-market. The latter works, now in regular use, are those of Lindley, Hooker, and Macgillivray; all, probably, founded upon and partly copied from the English Flora. We do not say this in objection to these works, it being impossible to make an original Flora of Britain; and we apprehend that Mr Macgillivray has been the more judicious in not copying Withering too implicitly. Dr Lindley published his *Synopsis of the British Flora* much about the same time (a year earlier, by the title-pages and preface) that Dr Hooker was preparing his British Flora. It differs from the Compendium of the English Flora, chiefly by following the example of Gray, in making an entire change of arrangement from the Linnean to the Jussieuan system, improved and modernized into what is now known as the "Natural System." The introduction of characters or descriptions of the orders necessarily accompanied this change, as well as many alterations in the descriptions of genera, with some few amendments in those of species. Frequent changes of name are also made; but the specific definitions are mostly copied from Smith's works. On the whole, there is a good deal of instructive novelty in the synopsis; but having been stereotyped, farther improvement is prevented, and editions succeeding to the first will fall behind the

science of the day. Macgillivray's work follows the Linnean arrangement, is popular through its title, and, in its utility to students, may be fairly enough classed with its three competitors, though wanting the authority which an established botanical name, in the author, gives to each of the others.

We have entered into these particulars with a view of showing the relation, if it may be so expressed, which the several Floras bear to each other, and for supplying hints to persons desirous of selecting only one or two; as it cannot usually happen that the same person should require all of them. Macgillivray's is the most elementary; Lindley's is the only one entirely arranged according to the natural system; Hooker's may safely be said to contain the best and fullest description of species among these three; while the English Flora, to full descriptions of the genera and species, unites the most complete set of references and synonyms; and, though in its full size the most expensive, its Compendium is the least so.

The advances made in our acquaintance with British plants since the publication of the first volumes of the English Flora, are considerable. When the fourth volume was published, seven additional species were added for the earlier volumes. The first edition of the British Flora, published two years later, in 1830, added about a score of others. The second edition, in 1831, contained seven or eight more, and the last edition increases the lists by above a dozen species. Five or six others are now known; so that, in the last ten or twelve years, about fifty species have been added to our list of flowering plants, and the additions to the cryptogamic lists may be reckoned by hundreds. But our readers must not imagine that fifty undisputedly native species of flowering plants have been discovered during this period. In fact, scarcely the half of this number can be regarded as fixed species and undoubted natives; and even some of these had been heretofore found, though mistaken or forgotten. Among the most interesting and least questionable additions, may be instanced Isnardia palustris, Orobanche caryophyllacea, Erica mediterranea, Erica ciliaris, Elatine hydropiper, Carex Vahlii, Potamogeton prælongus, Statice plantaginea, Astragalus alpinus, and Trifolium resupinatum.—But Pinguicula alpina, Cotoneaster vulgaris, Scirpus Savii, Silene italica, Hymenophyllum Wilsoni, and, probably, Habenaria chlorantha, had been previously observed and mistaken for other species. Tragopogon major, Oenanthe apiifolia, Fedia eriocarpa, Fedia mixta, Rosa Wilsoni, and others, appear scarcely entitled to rank higher than varieties. Asperula arvensis, Althæa hirsuta, and Lepidium draba should be looked upon as introduced species.

We fancy that persons fond of hunting out small blemishes, may find in the pages of the British Flora some few occasions for enjoying such amusement; which will surprise no one who considers the multitudinous avocations of its author. Such enjoyment we willingly leave to those who love it, and offer to the work, as a whole, our almost unqualified approbation; its plan is good; enough, and not too much is said in describing the species; and while the descriptions are sufficiently clear and simple for students, there is also matter calculated to fix the attention of professed botanists. The nice discriminations of Messrs Arnott, Wilson, and Borrer, appear in many places in the first volume; in the second volume, we may add to them the names of Greville, Harvey, Berkeley, Carmichael, Purton, and Mrs Griffiths, as contributing largely to it. The second part of this volume seems to have been confided almost entirely to the Rev. M. J. Berkeley, and much of the first part is properly attributable to Dr Greville and Mr Harvey;—we allude more particularly to the *Algæ*. With such a combination of skill for the different departments, it is impossible that the work should be otherwise than very valuable:—it is an admirable example of the advantages attendant on a division of labour, but union of talent.

We do, notwithstanding, object strongly to some points. In the first place, the names and descriptions of several species are still introduced, as if really belonging to British plants, although there is not a shadow of evidence to prove that such species have ever been found in Britain, and positive certainty that some of them were originally introduced into our Floras by mere blunders. Again, names and descriptions of imaginary species are still repeated, although relating to what are now known to be varieties, some of them very trifling varieties, and others so inconstant as to have become extinct, unless in the case of specimens preserved by "the curious." Such names and descriptions are said to be retained "in deference to the opinion" of one or other botanical authority, and contrary to the opinions of the author of the Flora. We dislike deference carried so far. It is the sacrifice of science to superstition,—of fact to fancy,—of truth to error. Such sacrifices operate as the dead-weights and drag-chains of improvement, moral as well as intellectual. This fault is, indeed, found in all our Floras; but it ought to be amended, and the author of the British Flora is the fittest person to set the example.

Transactions and Periodicals.—*British.*

The Edinburgh New Philosophical Journal. Conducted by Professor Jameson.—January to April 1836. Edinburgh: A. & C. Black. (Part 2d of Vol. xx.) 8vo.

I. *Zoology.*

P. J. Selby, Esq. "On the Quadrupeds and Birds inhabiting the county of Sutherland, observed there during an excursion in the summer of 1834, p. 286."—Contains a notice of the birds which were observed during the above-mentioned excursion, a similar notice of the Mammalia having been communicated in a preceding Number. The most worthy of remark are:—the occasional occurrence of the jerfalcon, (F. Islandicus,) the skin of a recently killed bird being procured at Keoldale. Muscicapa grisola was seen on the confines of the county, its most northern observed station in Scotland. Salicaria phragmites, Curruca cinerea, Sylvia trochilus were observed to the northern extremity of the county. Linaria montium takes the place which L. cannabina does in the lowlands, and is abundant. A bird considered to be Tetrao rupestris was shot on the Benmore range. Totanus glottis was found breeding. Also Anser segetum, Mareca penelope and Fuligula marilla. Colymbus arcticus was frequent, breeding on the more retired lochs.——J. V. Thomson, Deputy-Inspector of Hospitals. "Memoir on the star-fish of the genus Comatula, demonstrative of the Pentacrinus Europæus, being the young of our indigenous species," p. 295, with a plate.—An interesting memoir, detailing some very curious information regarding the supposed states of the above-mentioned animal. The evidence, however, though good, and most probable to be hereafter proved, is more circumstantial than direct.

II. *Botany.*

Sir Edward French Bromhead, Bart.—Remarks on the arrangement of the natural botanical families, p. 245.—The author's object in the arrangement which he proposes is, "to bring together the greatest possible number of admitted affinities, and if possible in continuous succession."——Dr Graham, list of new and rare plants which have lately flowered in the neighbourhood of Edinburgh, chiefly in the Royal Botanic Garden, p. 412.—"*Poinsettia.*—Involucrum monophyllum, androgynum, basi 5-loculare, extus appendiculatum, nectariferum; flores pedicellati, nudi, masculi bifariam in singulis loculis, ordonati, monandri; feminei solitarii, germen trilobum, ovulum solitarium singulis lobis."—Formed by Dr Graham from the Euphorbia pulcherrima of Willd. Rediscovered in Mexico by Mr Poinsette, and sent by him to Charleston in 1828, afterwards to Mr Buist of Philadelphia, whence it was brought to the Royal Botanic Garden of Edinburgh, by Mr J. Macnab in 1834.——*Sceptranthes.*—"Tubus clavatus erectus; limbus suberectus; filamenta tubo adherentia, alternatim breviora; antheræ lineares, erectæ prope faucem tubi subsessiles; stigma trifidum, erectum; germen capitatum." S. Drummondii, (Zephyranthes Drummondii, Cooperia Drummondii.) "The length of the tube, and especially the adhering filaments, seem to me to remove the plant from the genus Zephyranthes; the greater shortness of the tube, the less flattened limb, and the stipitate germen, prevent me from

uniting it to the genus Cooperia." *Gr.* Bulbs were sent from Texas by Mr Drummond.

The Magazine of Natural History, and Journal of Zoology, Botany, Mineralogy, Geology, and Meteorology. Conducted by J. C. Loudon. Lond. Jan.—April, 1836. 8vo.

This was, perhaps is to many, an entertaining and a useful miscellany, though latterly it has been declining in the interest and in the value of its communications. Such a large collection of facts, however, in relation especially to British Zoology and Botany, is brought within its volumes, that they must necessarily be consulted by every one who in future undertakes the history of our Fauna or Flora: but we will hint that much caution is necessary in the consultation, for the statements often rest on the testimony of those who have obviously begun to communicate the result of their researches before a sufficient experience has taught them all the difficulties and deceptions to which even a field-naturalist who attempts no more than to note down his observations is liable. With the present year the ninth volume commenced, and four numbers of it are before us, whose botanical and zoological contents we shall merely indicate.

I. *Zoology.*

Rylands on the Quinary or Natural System of M'Leay, Swainson, Vigors, &c. pp. 130 and 173. Mr R. does not seem to us competent to discuss the very difficult question he has ventured upon.——Wood on the propriety of altering established scientific names in Natural History, p. 138.——Waterton on the Brown or Gray Rat (Mus decumanus,) p. 1. A clever sketch, but too much interwoven with politics and satire.——Moss on the habits of a domesticated White Rat, p. 182.——On the habits of the Robin Red-breast, p. 6.——Ord on the Cow Bunting of the United States of America, p. 57.——Waterton on the Titmouse and the Woodpecker, p. 74.——Waterton on the Habits of the Jay, p. 187.——Taylor on the Birds of the Alleghany Mountain Range, p. 72. ——On the arrival of the summer Birds of Passage in the neighbourhood of Carlisle during the spring of 1835; to which are added observations on some of the scarcer Birds obtained in the same vicinity from November 10, 1834, to November 10, 1835, p. 185.——Templeton's Catalogue of Irish Crustacea, Myriapoda, and Arachnoida, p. 9.——Johnston on Astacilla longicornis, p. 80: and on Chordrocanthus lophii, p. 81.——Johnston on Limapontia nigra, p. 79. ——Forbes's Notices of Species of Naticidæ, p. 191. The figures illustrative of this paper are very unsatisfactory. In Natica monilifera, Mr F. has never found more than *one* tentaculum: has the male organ of generation not been mistaken for such?——Johnston on Psamathe fusca, p. 14, a new genus of Annelides; and on Planaria subauricula, p. 16, a supposed new species of the genus.

II. *Botany.*

Watson on the construction of Maps for illustrating the distribution of Plants, p. 17.——Walsh on Symphysis in Plants, p. 83.——Gardiner on the uses of the Nectary and Corolla in Plants, p. 195.——Henslow's Enumeration of Species and Varieties of Plants which have been deemed British, but whose indigenousness to Britain is considered to be questionable, p. 88.——Bromfield's notice of Habitats of some rare British Plants, p. 85.——Mallet on the seed-

dispersing apparatus of Erodium moschatum, p. 22.——Thompson on the Irish Algæ, p. 147.——Babington's Observations during a visit to Connamara and Joyce's Country, Ireland, in August 1835, p. 119.——Munby on the Natural History of the neighbourhood of Dijon in France in 1835, p. 117.——Forbes's Natural History Tour in Norway, p. 169.

Transactions and Periodicals—*Foreign.*

Annales des Sciences Naturelles. Zoologie, MM. Audouin et Milne-Edwards. *Botanique,* MM. Ad. Brongniart et Guillemin. Crochard and Co. Paris, Janvier 1836.

I. *Zoology.*

Dr Breschet, *Recherches Anatomiques et Physiologiques sur l'organe de l'ouie dans les oiseaux.* Two plates.—M. Breschet is the author also of a previous "Memoire sur l'Oreille des Reptiles," and proposes to continue the subject by another upon the more decidedly aquatic species. The present paper is divided into two sections, the first, historical, giving an account of the observations and researches upon the subject from Casserius in 1609 to Windischmann in 1831. The second contains a detailed description of the organs of hearing in birds, explained by two plates, and endeavours to illustrate, that there is a representation of all the parts which are found in the Mammalia, and a very close alliance in structure to many parts in the aquatic reptiles. The parts of *Corvus corax, Strix stridula and flammea, Meleagris gallopavo and Diomedea exulans,* are used for illustration.——Martin Saintange, *Recherches sur les Villosites du Chorion des Mammiferes.* This is a short extract from a paper read before the sitting of the Academie des Sciences.

II. *Botany.*

MM. Edwards and Colin. *Memoire de physiologie agricole sur la vegetation des Céréales sous les hautes Temperatures.*—A very interesting memoir to the vegetable physiologist and agriculturist. The experiments were made chiefly in the open air by sowing the grains at different seasons, and thus to a certain extent imitating the heat of warm climates. The principal results were; 1. that the weight, size, and quality of the grain sown had considerable influence under high temperature in its mature development; and 2. that the Cerealia of the North of Europe lose their power of mature development between 18° and 20° Centig. That they then continue in the blade only, which becomes large and luxuriant, and would form a thick and rich pasture. These experiments come nearly to what Humboldt had noted from observation on the Andes of America.——M. Auguste de Saint Hilaire—*Lettre sur un primula omis dans les flores de MM. Duby et Loiseleur, et sur la famille des primulacées.* The primula in question grows near the village of *Vernet,* and also around Montpelier, and was considered as only the P. officinalis; a comparison along with M. Dunal of Montpelier, has, however, made them out to be the P. Columnæ of Tenore—(P. suaveolens, Bertoloni,) and it appears to have been omitted in the Flora alluded to. The remainder of the letter is chiefly in answer to observations which have been made upon the author's "Memoire sur le Placenta," 1st and 2d.——Koch, *Description*

des Orobanches de la Flore d'Allemagne—continued from tom. iv. p. 361, and not completed.——M. Leon Dufour, *Notice sur le Sonchus scorzoneræformis, Lag. (Sc pumila, Cav.)—S. scorzoneræformis* "is a plant peculiar to the Zone of Olives, and delights in warm and dry situations." Found by Dufour on the argillaceous hills of Peralta and Tudela in Southern Navarre; described by Cavanilles from Valentian specimens, and by Lagasca gathered in Murcia. "The most singular feature in the plant, only mentioned by Cavanilles, is presented by the extremities of the divisions of the leaves, whatever the age of the plant, terminating in a subulated point white as snow; this is not occasioned by a peculiar gland or by down, but by a dry and white gangrene; the juices being withdrawn from the extremities, and the fibre alone remaining, deprive it as it were of its green pulp."—"This interesting sonchus presents another remarkable physiological fact. It is endowed with such exquisite irritability of some sub-epidermous glands, that the least pressure of the living plant, and sometimes touch only, causes small globules of milky juice to escape from the angles of the divisions of the leaves, and from the edges of the scales of the involucrum." M. Dufour considers this kind or manner of irritability as yet unnoticed.——C. G. Nees ab Esenbeck et C. Montague, *Jungermannicarum herbarii Montagneani Species exposuerunt.* The commencement only of a paper descriptive of the Jungermannia in the herbarium of the last mentioned botanist.

American Journal of Sciences and Arts. Conducted by Benjamin Silliman, M. D. LL. D. Vol. xxix. No. 2. January 1836. New-haven. London agent, O. Rich.

I. *Zoology.*

Charles Fox, of Durham, p. 291. Notice of some American Birds. A notice of some birds observed during a tour in North America. The author mentions an instance of the young of Molothrus pecoris in the nest of Fringilla socialis, where both species were reared and attended to. Wilson and Audubon mention that this had never taken place.

Judge Samuel Woodruff, p. 304, Notices in Natural History. Two notices, one upon a species of Snake supposed to be Col. sipedon, Linn. which the author found to be viviparous. The second, on what he terms the "Moulting of Snakes."—It extends from the end of May to the end of September, the largest specimens moulting latest. In casting the skin he observed it done in the following manner by one kept in confinement: "After the animal, by pressing the part against the wires, had succeeded in thrusting back the skin three or four inches upon the neck, he left the wires, and throwing his body into a coil round itself, so as to embrace within it the last fold the inverted skin, with a strong muscular pressure, made at the same time a powerful effort, shot his body forward through the coils, which unfolded one after another, and thus drew off the entire skin."

II. *Botany.*

Professor C. Dewey, Caricography.—A continuation of the appendix to the above gentleman's paper on the North American carices, p. 245. One plate.

INTELLIGENCE.

ZOOLOGICAL INFORMATION.

Habits of a common Seal (Phoca vitulina) kept in confinement.—The animal, of which the following is a short account, was received in June 1835, having been brought from Scotland to Holyhead in a collier. He had with two others been caught in a fishing net in the north of Scotland, and from the time he began his journey until he arrived at his destination, a period of fourteen days, he had no nourishment whatever except two spoonfuls of milk, he had been forced to swallow; nevertheless, he did not appear to have suffered from his fast. When turned into a small pool surrounded with iron railings, in which some roach and dace had been previously placed, he was highly delighted at his comparative liberty, diving after the fish, which he caught very readily so long as the water remained clear. After catching a fish he did not swallow it immediately, but bit and mumbled it a good deal to break the bones, played with it, and when dead and floating on the surface of the water, would dive, come up under it, and put it under. He appears to have no idea of fear while in the water, but while out of it, and suddenly alarmed, immediately began to scramble towards it. If a dog approached the railings, he would follow it round and round the pool, not, however, venturing out of the water. His time of sleep was always during the day, when he delighted to bask in the sun, sometimes reclining on his back, sometimes on his sides and belly. Towards evening he became very lively, catching his meals, and diving about the pool in all directions. I never knew a fish eaten that he did not catch and kill himself, not even one that was caught and thrown towards him alive, while he was on land. I was sometimes allowed to scratch or tickle him, but if any sudden noise or movement was made, he snapped at the fingers, though he did not continue to hold like an otter or badger.—*T. C. Eyton. February* 11, 1836.

Sitta Europea.—In the "Illustrations of British Ornithology," article Nuthatch, the author, relying upon the authority of Montagu, has stated that this bird is not met with in Cornwall; this he finds from a correspondent is not correct, he having frequently seen and killed it near Liskeard in that county.—P. J. S.

Loxia curvirostra.—Crossbills in great numbers have been very common in various districts of England and Scotland during the last autumn and winter, and, what is worthy of note, many remain with us up to the present date, viz. March 25, 1836.* This is at variance with M. Temminck's account of the bird, and its usual period of nidification, which in his Manual he states to be during the winter months, and whose authority is relied upon, in the Illustrations of Bri-

* May 3d.—A pair were shot at Twizel in the red plumage. The male frequently uttered his love note, and the eggs in the female were larger than peas.—P. J. S.

tish Ornithology. I have just dissected a female, shot yesterday, while feeding upon a larch tree, the seeds of which, divested of their outer skin, filled the œsophagus and crop. The state of the ovary was slightly advanced, some of the eggs having nearly attained the size of a No. 8 shot even. Is it likely that these late flocks will remain and breed in the northern parts of England and Scotland? This is a question of interest, and it is to be hoped that gentlemen possessing extensive pine and fir woods, and who atttend to ornithology, will endeavour to ascertain the fact. The appearance of the crossbill is much more frequent of late years than it used formerly to be, and this I attribute to the extensive plantations made in various directions, all of which contain a large proportion of the larch and other species of fir, the seed of which constitutes the favourite and principal food of this bird. The numerous specimens I have examined this season, have all been of the common species, nor have I heard of any authenticated instance of the *Loxia pytiopsittacus* having been met with.—P. J. S.

Macrorampus griseus.—A specimen has been lately procured of this very rare European bird in the vicinity of Carlisle, by T. C. Heysham, Esq. This is the third time it has occurred in Britain. Col. Montague's specimen; one mentioned by Mr Gould killed near Yarmouth; and that now recorded.

Curruca atricapilla and Phœnicura tithys wintering in Britain.—Among the Sylviadæ which occasionally winter in England is the Blackcap Warbler, Curruca atricapilla. This sweet songster, a correspondent informs me, has been a constant visitant in his garden, near Bristol, during the whole of the past winter, even whilst the frost and snow were pretty severe. In the winter of 1834–5, also, the same gentleman, about the end of December, shot a female of this species as it flew across in company with another, and he adds, I have heard the male in full song in some of the coldest days we have had. In Northumberland it is one of our earliest spring visitants, and from my notes I perceive that its arrival has sometimes preceded that of the yellow-willow wren, (Sylvia trochilus). The usual period of arrival is between the 14th and 18th of April. A specimen of Phœnicura tithys was shot near the same gentleman's residence in December last, flying in company with the stonechat in some gorse and whin bushes.—P. J. S.

Phycis furcatus—has lastly been taken on the coast of the Solway Firth, near Whitehaven. *T. C. Heysham, March* 1836. "First discovered on the Cornish coast by Mr Couch, occurred also at St Andrews, and seen in the Carlisle market in December 1833 by Mr Heysham."*

Raniceps trifurcatus.—Three species were taken in the Firth of Forth in February last (1836,) by the net which is used in the neighbourhood of Alloa for the capture of sparlings (Osmerus eperlanus.) They are known there to some of the fishermen by the name of *black fish*, and acknowledged to be of rare occurrence.—*R. Parnell.*

Charadrius morinellus, breeding in Cumberland.—In the neighbourhood of

* Yarrell, Br. Fishes.

Carlisle, dottrels seldom make their appearance before the middle of May, about which time they are occasionally seen in different localities in flocks, which vary in number from four to fifteen, and almost invariably resort to heaths, barren pastures, fallow ground, &c. in open and exposed situations, where they continue if unmolested from ten days to a fortnight, and then retire to the mountains in the vicinity of the lakes to breed. The most favourite breeding haunts of these birds are always near to or on the summits of the highest mountains, particularly those that are densely covered with the woolly fringe moss (Trichostomum lanuginosum, Hedw.) which, indeed, grows more or less profusely on nearly all the most elevated parts of this alpine district. In these lonely places they constantly reside during the whole of the breeding season, a considerable part of the time enveloped in clouds and almost daily drenched with rain, or the wetting mists, so extremely prevalent in these dreary regions; and there can be little doubt that it is owing, in a great measure, to this peculiar feature in their economy that they have remained so long in obscurity during the period of incubation. After repeated excursions through the lake district for the express purpose in the summer of 1835, of looking for their nests, I was so fortunate as to obtain the eggs in two different localities; namely, three on Whiteside, contiguous to Helvellyn, on the 29th of June, and two on the 5th of July, on Robinson Fell, in the vicinity of Buttermere; the former had been incubated twelve or fourteen days, the latter only recently laid, and in both instances the birds were seen to leave their eggs; one on quitting them, immediately spread out its wings and tail, which were trailed on the ground a short distance, and thus flew away without uttering a single note. On this day (July 5, 1835,) a young bird a few days old was also captured on the same Fell.—*T. C. Heysham.*

Hipparchia blandina.—Very abundant in most of the upland sheep pastures in Dumfries-shire, extending to the lower districts along the smaller valleys, during July and the first week of August; in very great profusion in the head of the vale of Dryfe, and in Eskdale, extending without interruption to the confines of Roxburghshire.

Conops nigra.—Amongst the few Dipterous insects taken in Sutherlandshire, during an excursion to explore the natural productions of that county in the summer of 1834, we find a fine example of the *Conops nigra* of De Geer,—a species which has not hitherto been included in our indigenous lists. It is one of the largest of the genus, measuring about seven lines in length, and is distinguished from the other species by having the abdomen entirely black. The forehead and countenance ferruginous; the thorax wholly black; and the anterior half of the wings deep yellow. The halteres and legs are reddish-yellow, the latter with the base of the thighs black. It is figured and described by De Geer, vol. vi. p. 265, pl. 15, fig. 9. The species to which it is most nearly allied is *C. macrocephala*, Linn. of which Fallen has supposed it to be a variety. This opinion, however, will not be adopted by those who have had an opportunity of examining both insects, the distinctive marks of *C. nigra* obviously exceeding the limits of variation which we are authorized to assign even to very inconstant species. It was first found in Sweden, where it appears to be very rare; and its occurrence in Sutherland is not without interest, as affording another proof, among several others which have been advanced lately, that the insect productions of

the northern parts of Scotland become similar to those of corresponding latitudes on the Continent.—For a further account of *C. nigra*, see Herbst *gemeinn. Naturg.* viii. 117, 5, tab. 70, fig. 5.—Meigen, *Europais Zweiflugeligen Insecten*, iv. 126.—*Rev. James Duncan.*

BOTANICAL INFORMATION.

Botanical Society in Edinburgh.—With much pleasure we insert the following notice of the commencement of a Botanical Society in Edinburgh, a district whose Flora is rich, and whose botanists are able. The names of the individuals who have been placed at its head are guarantee for the principles upon which it is proposed to be conducted, and we trust that this institution will ere long assume an important part in the science of Scotland. " We rejoice to observe that a Botanical Society has been established in Edinburgh. At a meeting which was held on the 17th of March, the Society was constituted under the title of the " Botanical Society of Edinburgh." The meetings to be held on the second Thursday of every month from November to July, inclusive.

Professor Graham has been elected President, and Drs Greville and Balfour Vice-Presidents of the Society for the present year.

The advancement of botanical science is the object of the Society. Its operations will for sometime be confined principally to the holding of periodical meetings, to correspondence, to the formation of an Herbarium, and the interchange of specimens. The last is a new feature in the constitution of such a Society, and will be conducted by a Committee, in accordance with certain rules embodied in the laws. The desiderata of botanists in all parts of the Kingdom will be supplied, as far as possible, from the Society's duplicates, and individuals will secure the important advantage of exchanging the botanical productions of their respective districts for those of others more remotely situated. The benefits resulting to science, as well as individuals, by this arrangement, will, it is hoped, be considerable; especially in regard to the Geographical Distribution of Plants in the British Islands, and in the formation of Local Floras. The Society, besides, contemplates an extension of this plan by promoting an exchange of specimens with botanists in other parts of the world.

The members will be divided into the following classes: Resident, Non-Resident, Foreign and Associate. Any person wishing to become a Non-Resident member must be recommended by two individuals belonging to some scientific or literary society, and pay a contribution of two guineas, which without any additional payment, will entitle him, as long as he continues annually to send specimens to the Society, to a participation in the duplicates. To become a Foreign Member, it is necessary to transmit 500 specimens, including at least 100 species, or a botanical work of which the candidate is the author, the former alternative only entitling him to a share of the Society's duplicates. To continue to participate in these duplicates, he must afterwards contribute annually 300 specimens, including at least 50 species.

The Flora of Edinburgh, which is particularly rich, will afford a constant supply of valuable duplicates, and others will be regularly obtained from other parts of Scotland,—especially the rarer Alpine species.

Local Secretaries will be appointed in different parts of the kingdom. In the meantime all communications are to be addressed (postage paid) to the Secretary, W. H. Campbell, Esq. 21, Society, Brown Square, Edinburgh."

Works on British Botany for 1836.—The following works upon the Botany of Great Britain, have either been published since the commencement of the present year, or are in preparation :—The English Flora, vol. v. part 2.—Or the British Flora, vol. ii. part 2. By W. J. Hooker, LL. D. F. R. S., &c. and Rev. M. J. Berkeley, M. A., F. L. S., &c. 8vo, pp. 418. Longman and Co. (The *Fungi* to complete the two works named.) *Published in February last.*—The Flora Metropolitana, or Botanical Rambles within thirty miles of London. By Daniel Cooper, 12mo, pp. 139. S. Highley. *Published in March last.*—A Flora of Nottinghamshire. By W. Howitt, M. D. *Nearly ready.*—The Northern Flora; or, a Description of the Plants of the North and East of Scotland. By Alexander Murray, M. D. *In the press.*—A Flora of Yorkshire. By Mr Baines. *Said to be ready for the press.*—A Flora of Shropshire. By W. A. Leighton, Esq. B. A. *In preparation.*—A catalogue of plants in the environs of Halifax. *Promised by Mr Leyland.*

Jungermannia Woodsii, Hook.—Dr Greville found this beautiful and rare British species in 1833, on Ben Hope, Sutherlandshire. Ireland has previously been its only ascertained British station.—R. K. G.

Carex Buxbaumii, Wahl.—D. Moore, Esq. who has been for some time engaged in examining the botanical productions of the county of Londonderry, for a work which is to form part of "The Statistical Account of the Ordnance Survey of Ireland," has been rewarded by the discovery of many rarities, of which some are quite novel to the Flora of the sister kingdom, and one is altogether new to the British isles, the *Carex Buxbaumii* of Wahlenberg, which was detected on an island in Loch Neagh. The nearest affinity of this plant is with the very scarce *C. tomentosa*; but Mr Moore and Mr Mackay at once correctly distinguished it from that species, by the less downy and larger fruit; the strongly mucronate scales; and above all, the absence of a wholly male spikelet; the base of the upper male spikelet being alone furnished with male flowers. It will rank next to *C. Vahlii*, and indeed, together with it and *C. atrata*, should form a separate section, distinguished by the circumstance above-mentioned, by the upper spike being androgynous; male below, and stigmas three. The character may be thus rendered :—"Carex Buxbaumii; spicis sub 4 sessilibus approximatis oblongis, terminali androgyna, squamis ovato-lanceolatis longe (masculinis brevi) cuspidatis, capsulis ellipticis substipitatis leviter pubescentibus obtusis bicuspidatis, bracteis foliaceis vix caulem superantibus, vaginis nullis."—*C. Buxbaumii, Wahl. Act. Holm.* f. 803, p. 163.—*Fl. Lapp.* p. 244.—*Fl. Dan.* t. 1406.—*Mackay, Fl. Hib. ined.*—*C. polygama, Schkuhr. Cario.* tab. G. g. f. 76. Hab. one of the small islands of Lough Neagh, county Derry, D. Moore, Esq.—*Comp. to Bot. Mag. for May* 1836.

MISCELLANEOUS INFORMATION.

Zoological Garden at Edinburgh.—Proposals for the institution of a Zoological garden in Edinburgh have been issued under the auspices of Sir Thomas Dick Lauder; Professor Jameson; Dr Traill; James Wilson, Esq.; Dr Spittal; Convener Dick; and Dr Neill; and we sincerely wish it success. Shareholders are proposed to have privileges similar to those enjoyed by the members of the gardens of London and Dublin. Various situations are proposed, the Meadows;

on the Grange estate; the Coates estate near Bell's Mills and in the vicinity of the Botanic garden. But in the selection, let every care be taken to choose a dry, airy, but sheltered spot; one low and damp, such as the Meadows, would soon be fatal to all the more tender animals, as has been already experienced in other institutions where a southern climate gave greater advantages.

Histoire Naturelle des iles Canaries.—Five numbers of this work by P. Barker Webb, Esq. and M. Sabin Bertholet, had appeared in April last. It will be composed of 50 numbers, containing a portion of 4to letter-press, and five or six folio plates, and when completed will bind in three volumes. The first will be devoted to the History of the islands; the second to the Zoology; the third to the Botany. The plates, according to the subject, are engraved on copper or stone.

Monograph of the Genus Oliva.—M. Duclos has ready for publication a monograph of the genus *Oliva*. The materials have been collecting for twenty-five years, and the series of shells to trace the variations of form, and marking, and colour is extremely rich. He reduces Lamarck's 67 species to 44, but adds to these 94, describing in all 138 species; what he considers varieties are very extensive, so many as 40 being sometimes ranged under one species. The plates, 35 in number, are folio, beautifully executed, and the four last are devoted exclusively to anatomical details, and to the inhabitants of the shells, drawn from life.—*Rapport de M. Dumeril à l'Acad. de Scien. Jan.* 1836.

Voyage dans L'Amerique Meridionale D'Orbigny.—Eleven numbers of this beautiful and important work have reached us; but the different portions of it appear in a manner so miscellaneous, that it is scarcely possible to give any good notion of it in its present state. Only two plates of the Mammalia, and one devoted to botany have appeared, the Mollusca occupying the greater portion of the Zoological numbers. Of the descriptive part, written in the form of a journal, 312 pages are published, occupying the two first years of the travels, chiefly in Paraguay, and are interesting, though perhaps the composition is not in the most elegant style.

Temminck, Monographies et Recueil de planches coloriées.—The second volume of the "*Monographies de Mammalogie*" is now in the press, and will appear ere long; it is now above eight years since the first volume was completed. The "Recueil de planches coloriées" has now reached its 93d livraison, and it is proposed to complete the first series with the 100th liv., being in all 595 plates, with 755 figures. An arranged catalogue of the pl. Enluminées, and the pl. Coloriées will accompany the last liv., of which a part has already appeared; and on the completion of that series, M. Temminck proposes, if he meets with sufficient encouragement, to commence a second series as a continuation.—Int. to Manuel d'Ornitol. Trois. part.

New general History of Birds.—Mr Gould is preparing a general history of birds, to be published in numbers. The size, royal and imperial 4to, to range with Temminck's Planches coloriées, Wilson's N. A. Ornithology, &c. A figure of a typical form in each genus will be given, and, as far as possible, species which have not been previously represented will be selected. The plates we

have seen are lithographic, drawn by Mrs Gould, and beautifully executed. — Crossodeira, N. G.—Microura, N. G.—Paradoxornis, N. G. (See p. 62)—Todus, Sialia, Accentor, will be illustrated in the 1st number.

Dr Ed. Ruppel.—This indefatigable zoologist has commenced a new work entitled " Neue Wirbelthiere zu der fauna von Abyssinien gehörig entdeckt und beschrieben." We have seen the first four fasciculi, one devoted to each branch, Mammalia, Aves, Reptilia, Pisces. The plates are lithographic, the text German, with Latin specific descriptions. Some very interesting species are figured and described.

R. Cunningham, Colonial Botanist New South Wales.—Early in the present year, accounts were brought from New South Wales, which gave the deepest distress to the friends and relatives of Mr R. Cunningham, heightened, if possible, by a kind of uncertainty of their authenticity. Official accounts, however, have now been received, which in part confirm the melancholy fate of this zealous botanist. The following extract will best convey the information, and we would still fondly hope, that, under the guidance of Providence, he may be yet preserved and in time restored to those who now have to lament his absence. " But a grievous misfortune befel the expedition in the loss of Mr Cunningham, the Colonial Botanist, who wandered from the party near the head of the river Bogan, on the 17th of April. After an anxious search, continued for twelve days, during which the party halted, his horse was traced till found dead, having still the saddle on, and the bridle in its mouth. It appeared that Mr Cunningham, after losing his horse, had directed his own steps northward; we traced them into the Bogan, and westward along the bed of that river for twenty miles, and until they disappeared near a recent encampment of natives. There a small portion of the skirt of his coat was found, also some fragments of a map which I had seen in his possession. There were two distinct tribes of natives on the Bogan, but from those with whom we had communication we could learn nothing of his fate. I have ever since indulged a hope that he might have crossed to the Macquarie, and so returned to the settled districts, but this hope has not relieved me much from the most painful apprehensions, considering the dispositions of the natives. Whether Mr Cunningham really survives or not, his absence has made a melancholy blank in our party, and has certainly caused a serious loss to science."—*Athenæum.*

Dr Smith.—We have satisfaction in announcing that Dr Smith, the superintendent of the South African Museum, has returned in safety to the Cape from his expedition to the interior. He arrived in the first week of February, and in general has been successful; but no particulars have yet reached Europe.

NOTICES AND PROCEEDINGS OF SOCIETIES—LONDON.

ENTOMOLOGICAL SOCIETY, April 4th.—Observations and experiments for excluding the house and other flies from apartments, by means of nets, by the Rev. Edward Stanley, M. A.—Descriptions of Zeuxo Westwoodiana, a new crustaceous insect from the Island of the Mauritius by Robert Templeton.—Notes on the habits of Asmia atricapilla, and upon the mode in which its nest is constructed, by G. M. Waterhouse.—Descriptions of six new East Indian Coleoptera, by W. W. Saunders.—Various living bees of different species were exhibited by

Mr Picking attached by the remarkable parasites belonging to the genus Xylops. —*Athenæum.*

May 2.—1. *Entomological Notices*, by W. Spence, Esq., F. R. S., including "Observations upon, and suggestions for obviating the great annual expenditure caused in Brussels by the attacks of some of the timber-boring Beetles in the wood-work of houses;" also, "Observations upon the injury caused by the Scolytus destructor to the Elm-trees in the Park at Brussels;" also, "Upon a disease to which Silk-worms are subject in Italy, termed the Muscadine, and which is proved to be caused by the growth, within and upon the bodies of these caterpillars, of a minute parasitic fungus," thus affording, as the Rev. Edward Stanley noticed, an analogy and a clue to a solution of the difficulties connected with the nature of the vegetable wasp of Surinam. 2. "Descriptions of a new genus, and several new species belonging to the Coleopterous family Paussidæ, from the collection of M. H. Gory of Paris," by J. O. Westwood, F. L. S. Secretary of the Society. 3. "Extracts (relating to the *Annulosa*) from a memoir upon the comparative development of the nervous system of the various classes of animals with that of the human subject, illustrated by a beautiful series of preparations and drawings," by John Anderson, Esq., of Richmond. 4. "Notices of the destruction of the Canes in the West Indies by the Mole Cricket," communicated by J. C. Johnstone, Esq., M. E. S. of Grenada, and which, upon the motion of Col. Sykes, was referred to the Cane-fly Committee of the Entomological Society.—*Athenæum.*

Medico-Botanical Society, 8th March 1836.—Earl Stanhope, President, in the chair; Dr M'Reight was elected a Fellow of the Society.—Dr Morries, F. R. S. Edinburgh, and Professor of Toxicology to the society, made some observations on opium, conium, digitalis, tobacco, and hyoscyamus, more especially with reference to their empyreumatic oils. There appears to be considerable resemblance between the oils of these plants: they are obtained by distillation from the dried powdered leaves. A specimen of the oil of hyoscyamus was exhibited, which presented the following characters: It has a light yellow colour, and an oily appearance; a very powerful, virose odour, so penetrating and volatile, as to be perceptible at a considerable distance, even when the bottle is closed. Eight or nine drops, Dr Morries stated, would destroy life in an hour and a-half, and he observed that it was nearly as fatal as prussic acid: a much more powerful preparation, however, might be obtained, by distilling this empyreumatic oil with potass; the same quantity of the products would cause death in from thirty seconds to two minutes.—*Communicated by Mr Foote.*

Edinburgh.

Royal Society, January 18, 1836.—Right Honourable Lord Greenock, V. P. in the chair. Observations and experiments on the coloured and uncolourable matters in the leaves and flowers of plants, particularly in reference to the principles upon which acids and alkalies act in producing red or yellow or green colours, by Dr Hope.

March 7th, Sir T. Mackdougall Brisbane, President, in the chair.—Communications were read by Dr Christison and Dr Graham, on the composition and the botanical origin of Gamboge.

Wernerian Society, January 9, 1836.—Professor Traill, V. P. in the Chair.

Mr James Wilson read a paper on the birds included under the Genus Eurylaimus of Horsfield, illustrating his remarks by species and figures.

Sir Patrick Walker read a notice regarding the occurrence of Motacilla neglecta, Gould, on the banks of the Water of Leith,* and of Ardea minuta being killed at the mouth of the Tyne in East Lothian.

February 6th, R. Stevenson, Esq. in the Chair.—Professor Jameson exhibited a series of birds collected by Captain Clunie, among which were species of Sula alba from Moreton bay.

A species of Pernis from India was exhibited and characterized as new under the title of P. Elliotii, the donator of the species to the Museum.

Two buzzards, said to be killed in Britain, one near Birmingham, the other near Newcastle, were exhibited. The particulars of their capture were to be ascertained.†

In May 1834, a series of premiums were proposed by the Wernerian Society, —"The best geological account of the three Lothians, with map, sections, and specimens, to be given in December 1835, Twenty Sovereigns.——The best Natural and Economical History of the Fishes, marine, fluviatile, and lacustrine of the river district of the Firth of Forth, with collection of specimens, to be given in December 1835, Ten Sovereigns.——The best account of the Entomology of the three Lothians, with collection, and map of distribution of the insects, to be given in December 1836, Ten Sovereigns.——Best Essay on the Botany of the Mountains of Scotland, in connection with their geological structure and composition, specimens and map of distribution of plants, to be given in December 1837, Ten Sovereigns.——Best account of all the Avertebrate animals, (with the exception of Insects and their larvæ) inhabiting rivers and Firth of Forth, their tributary streams and lakes, with collection of specimens, to be given in December 1837, Ten Sovereigns." One essay on the *Ichthyology of the Firth of Forth* has been sent in, accompanied by numerous specimens, and one on the *Geology of the three Lothians*, accompanied by a map and specimens.

Provincial.

Carlisle Literary and Philosophical Society,—instituted in the commencement of 1832. Earl of Lonsdale, Patron. Richard Ferguson, Esq. High Sheriff of the county of Cumberland, president for the year 1836. Have commenced a library and museum for the reception of Zoological and Mineralogical specimens—for objects of art and antiquities—and a collection of philosophical instruments. Twelve papers were read by members during 1835—chiefly on mineralogy and meteorology; on 7th December by Mr Pears a paper on "Botany and Vegetable Physiology."

The subscription annually for ordinary members is one guinea, with a like sum for entry money. Ladies are admitted as subscribers at half-price without

* We trust that specimens will be secured during the summer. This is the second time that M. neglecta has been recorded occurring near Edinburgh; but the birds seem always to have been neglected, and at this time we are not sure that there is a specimen in town.

† We saw the skins, and at the time expressed our doubt of their being killed in this country, from the manner in which they were prepared. The one is an African, the other an Indian species.

the entrance charge, and have a right to admission to the lectures and privileges of the museum. The meetings of the society are held on the first Monday of each month at seven in evening. The first annual report is published, Hudson Scot Office, Carlisle, 1836, pp. 23.

OBITUARY.

"The Rev. JOHN TOZER, late Curate of St Petrock, Exeter; where he was much respected. His body was found drowned near Shrewsbury, and not recognized by any one in the neighbourhood; but, the circumstance being made known by a newspaper sent accidentally to Teignmouth, the description caused strong suspicion of its referring to Mr T.; and a relation went off immediately, who examined many articles of his dress, and collected so much information as to leave not the slightest doubt of his identity. The body, it is supposed, had lain several weeks in the water." *Gent. Mag. April* 1836, p. 438.—Mr Tozer, whose melancholy fate is here recorded, was well known to British botanists, for he is repeatedly quoted in the *British Flora* of Hooker, and, in the *Flora Devoniensis*, as an authority for habitats of some of our rarest plants. He was the discoverer of the first British station of *Erica ciliaris*, and of the *Bryum Tozeri*, so beautifully figured in the *Scottish Cryptogamic Flora* of Dr Greville, vol. v. pl. 285. "I rejoice," says Dr Greville, "in being able to bestow upon it the name of my indefatigable friend, who is also known to have distinguished himself by finding *Schistostega pennata*, after it had apparently disappeared for many years."

January 1. 1836. "At Shropham villa, Norfolk, aged 33, (an evident misprint, he was in his 58th year. See *Mag. Nat. Hist.* ix. p. 164.) The Rev. *George Reading Leathes*, Rector of Limpenhoe with Southwood, and of Wickhampsted, Norfolk. He was of Jesus College, Cambridge, where he graduated B. A. 1801, M. A. 1813, was presented to both his livings in 1803 and in 1804. by J. F. Leathes, Esq. He was attacked on Christmas day by a fit of apoplexy, whilst in the reading desk, and lingered for one week, until the following Friday. He was well known as a naturalist, a horticulturist, and a general patron of the fine arts." *Gent. Mag. April* 1836, p. 439. His name is commemorated in the *Ovula Leathsii* of Sowerby, of which he was the discoverer.

The Baron de Férussac.—We are sorry to announce the death of the indefatigable Baron de Férussac, the founder and editor of the *Bulletin Universel.* He had long suffered from an affection of the lungs, but did not quit his labours till just before his death. Among other excellent works, his natural history of the Mollusca was one of the first, and is illustrated by the best plates published in France; his monograph of the *Cephalopoda* is equally beautiful, but neither of these undertakings is finished. He was always anxious to forward the views of those connected with science, and was particularly obliging to foreigners. He was in his fifty-second year.—*Athenæum*, 2d April 1836. (In an early number we shall give an account of the works of this excellent molluscologist.)

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